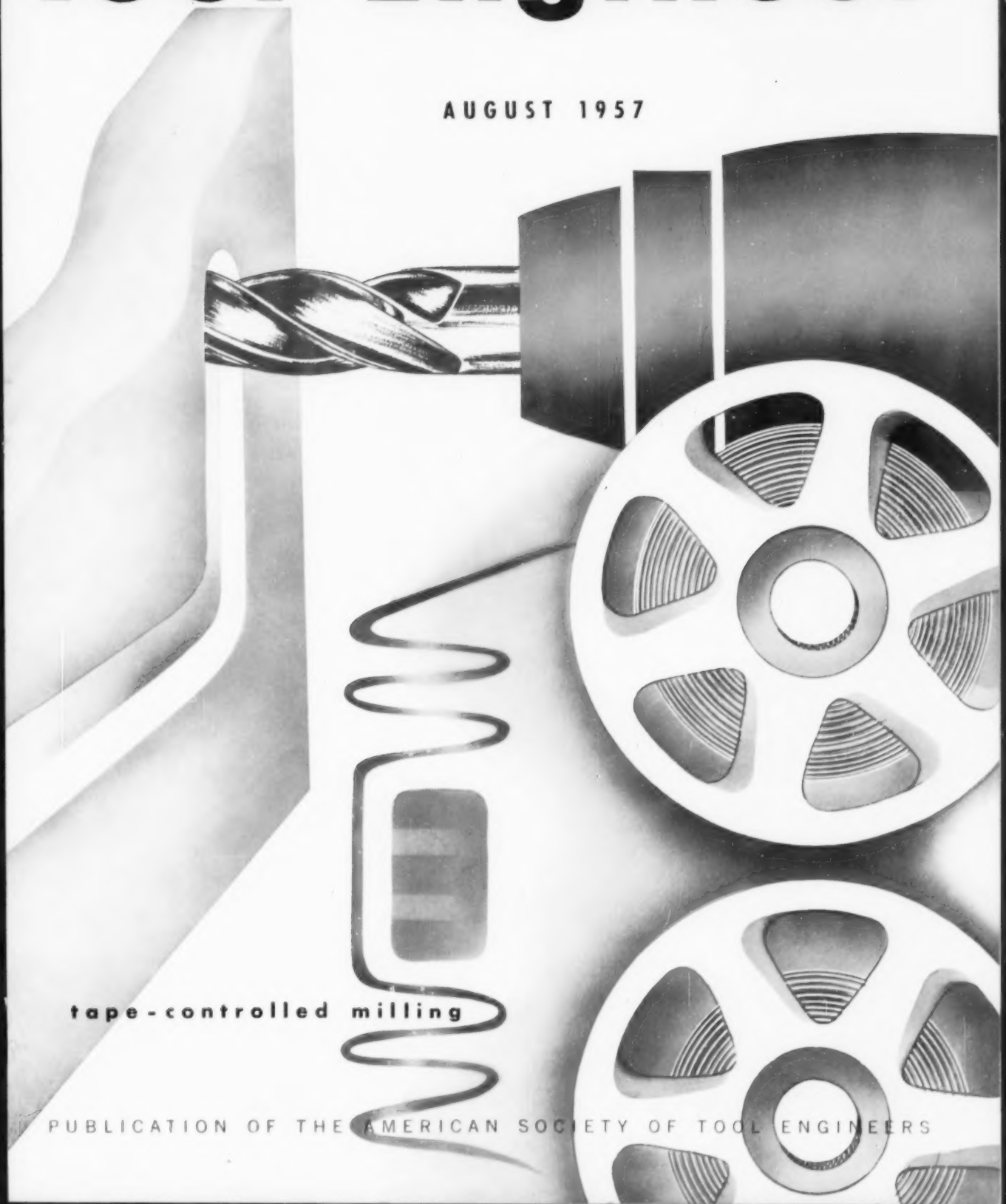
THE Tool Engineer

AUGUST 1957



tape-controlled milling

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

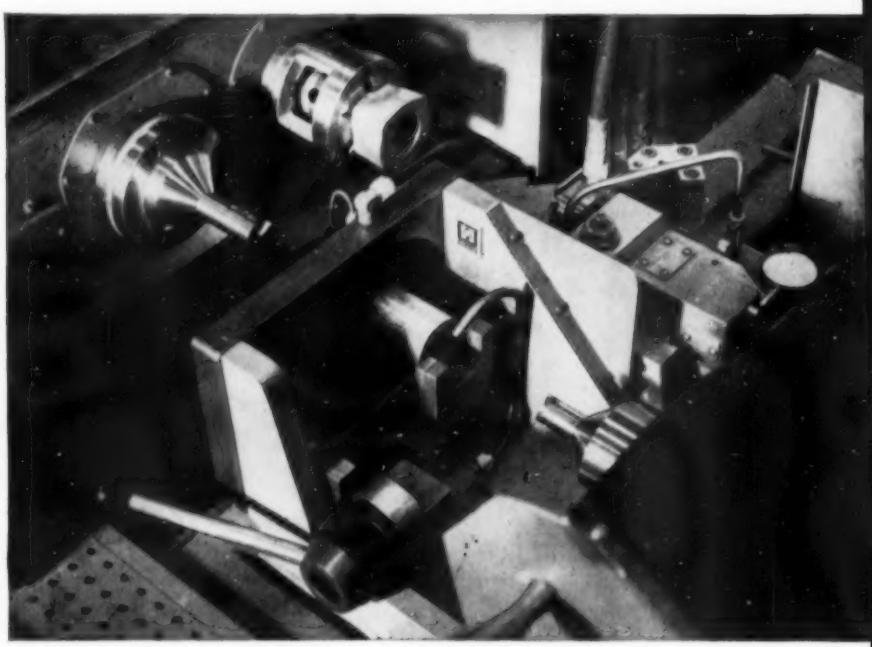
IN ANY MACHINE TOOL OPERATION,

where do you look for the PAY-OFF?

- ☐ On the machine itself
- ☐ In subsequent assembly operations
- ☐ In the finished product

On a Heald BORE-MATIC, pay-off time at the machine is only the beginning!

For example: A manufacturer of portable tools purchased the Model 222 Bore-Matic shown here, for boring and facing various sizes of tool housings. Although results showed a worthwhile time saving of about 20%, this alone was hardly enough to justify the cost of the machine. But analysis of subsequent assembly operations some time later showed substantially reduced assembly times which *fully justified the investment.* Although average Borizing time is only 1 or 2 minutes per piece, the assembly operations take from 30 minutes to 2½ hours and involve as many as five pieces that now fit exactly right because they've been through the Bore-Matic. However, the customer reports that the *major* advantage of the machine is improvement in quality of the finished product. Under previous methods, frequent trouble was encountered due to distortion of metal from improper clamping and locating. So this Heald Bore-Matic not only saved machine time and cut production costs, but also contributed to a *better* and *more saleable product.*



THE *precision production* that you get from a Heald Bore-Matic or Internal Grinder is not an end in itself. Actually, it's the start of a chain reaction that will be felt in subsequent assembly operations and even in the performance and saleability of the finished product as well.

When you measure the length of time it will take for a machine to pay for itself, it's important to look at the *overall* picture. Take the savings you get at the machine. Add the savings from reduced assembly time. And if you can put a dollar value on the resulting improvement in product quality, add this too. You'll find that . . .

IT PAYS TO COME TO HEALD

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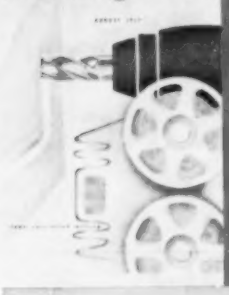

COVER: Cutting its way steadily along a predetermined path, this end mill is automatically guided by numerically coded tape. Practical applications of tape control, which are simplifying production of difficult parts, are described in an article starting page 83.

The Tool Engineer

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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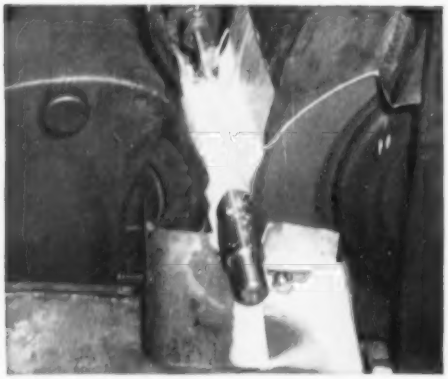
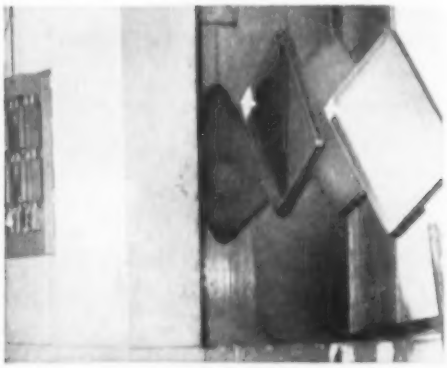
CUTTING



GRINDING

ROLLING



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THE TOOL ENGINEER

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Publication Office:
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription: members $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00. Copyright 1957, American Society of Tool Engineers.

Better Jobs for More People

Automation will not be the cause of mass unemployment but will produce changes in jobs and occupations which will require adaptation of the labor force. These were the words of Ewan Clague, U. S. Commissioner of Labor Statistics, in an address at Boston before an International Council of Industrial Editors. He also pointed out that the productive capacity of the American economy can grow at the rate of three or four percent a year while the number of new workers is only about 1.5 percent per year. Automation will be necessary to achieve the output of products and services which the American economy can consume.

These facts are familiar to management and to tool engineers but are not readily accepted by the worker. The reason is simple. He sees his job evaporating into thin air. No one bothers to point out opportunities to him. No one tries to upgrade him beyond the monotonous routine of repetitive work. If he can be shown that this can be done and, at the same time, provide more earning power for him as an individual, there is no question but that he would be a strong advocate of improved production methods.

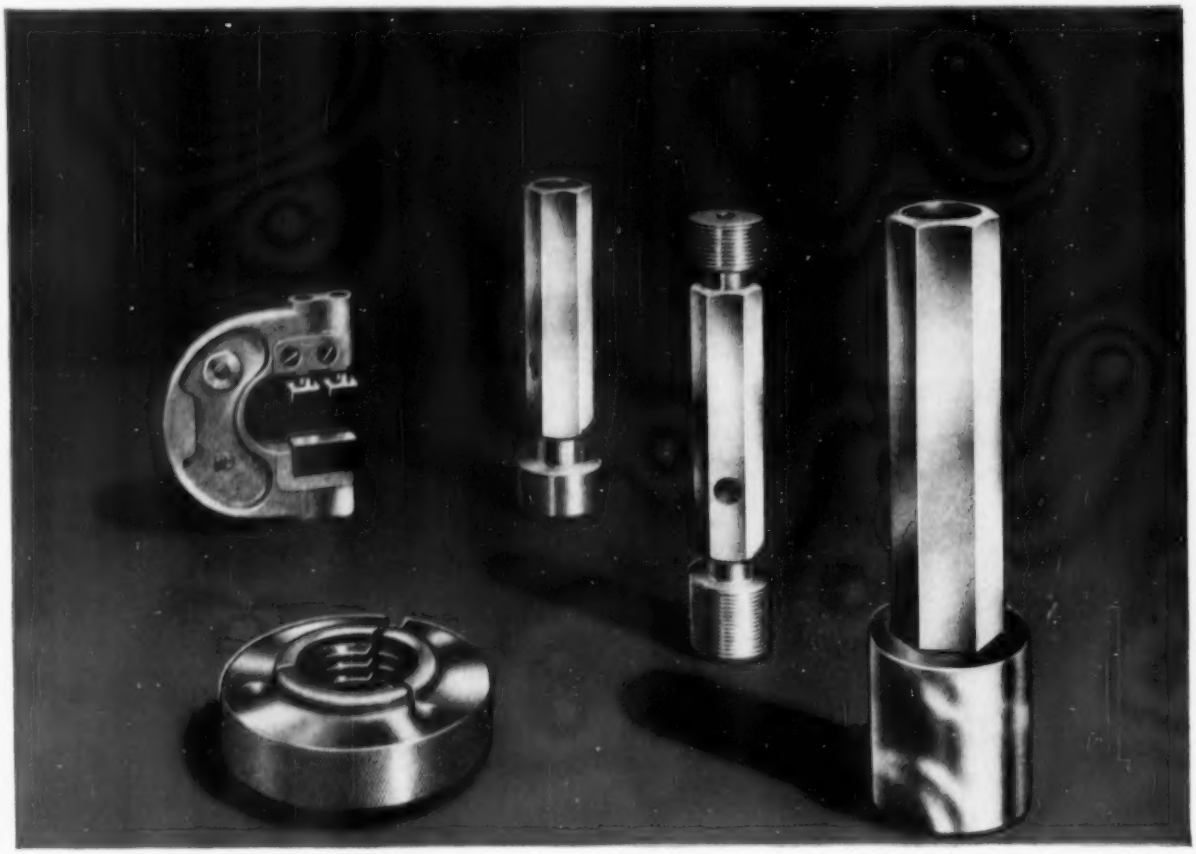
The story of Fred Crawford at Thompson Products illustrates the point. His job was to fire 150 employees so that the company could show a profit. He purchased machines to replace these men. Many years later, with a work force of 25,000, not a single man had been fired as a result of increased productivity.

It is industry's responsibility to show the worker how he can fit into a plan for mechanized production as much as it is to prove to stockholders that automation is profitable. What is best for the public is not always appreciated by the breadwinner. The tool engineer can and should be concerned with the worker when he is developing and applying mechanization. He not only takes the drudgery out of work but also creates better jobs.

John W Greve

EDITOR

THREADWELL GAGES



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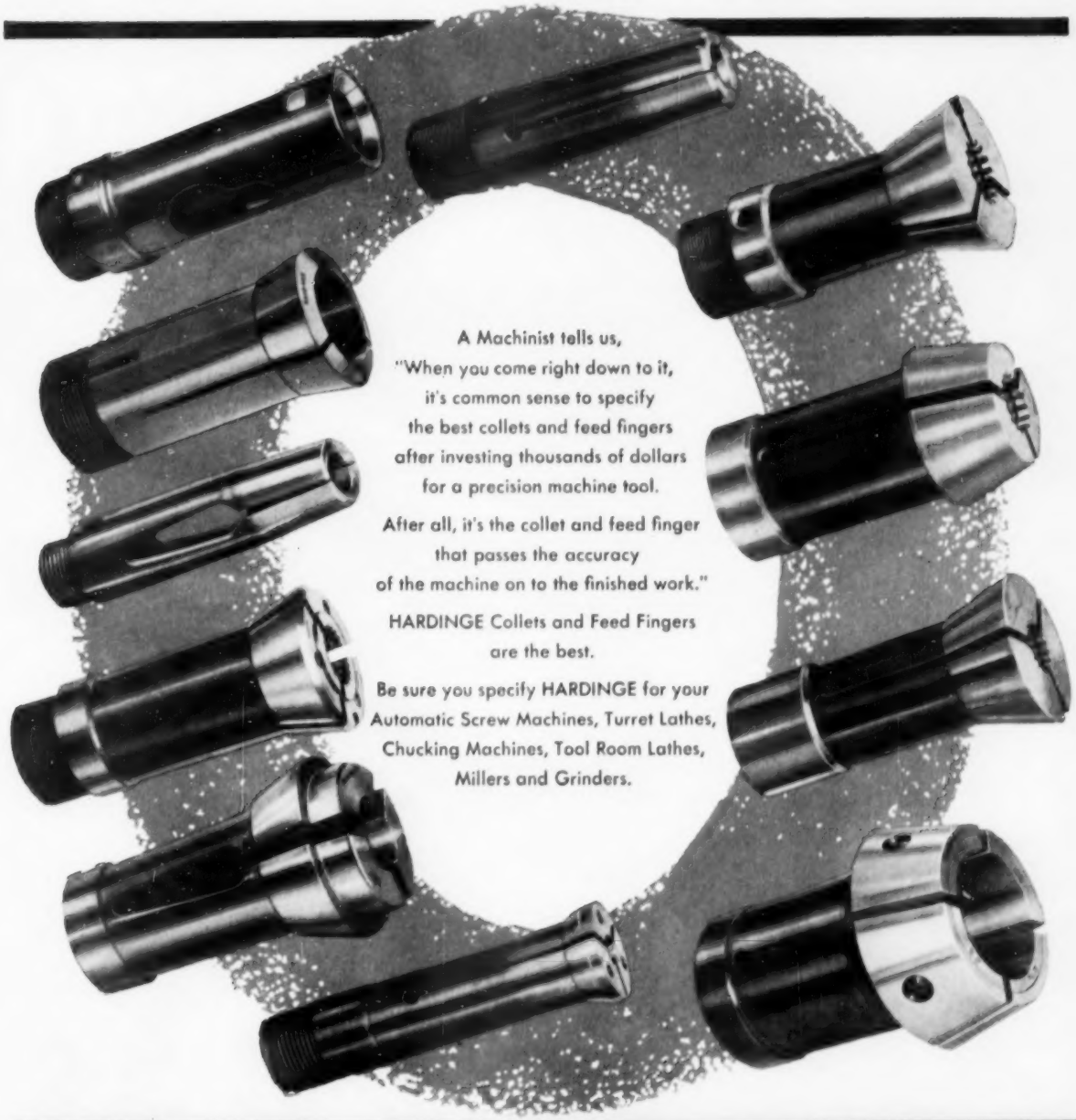

A Machinist tells us,
"When you come right down to it,
it's common sense to specify
the best collets and feed fingers
after investing thousands of dollars
for a precision machine tool.

After all, it's the collet and feed finger
that passes the accuracy
of the machine on to the finished work."

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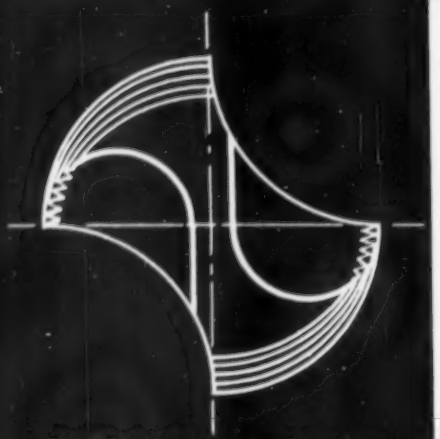

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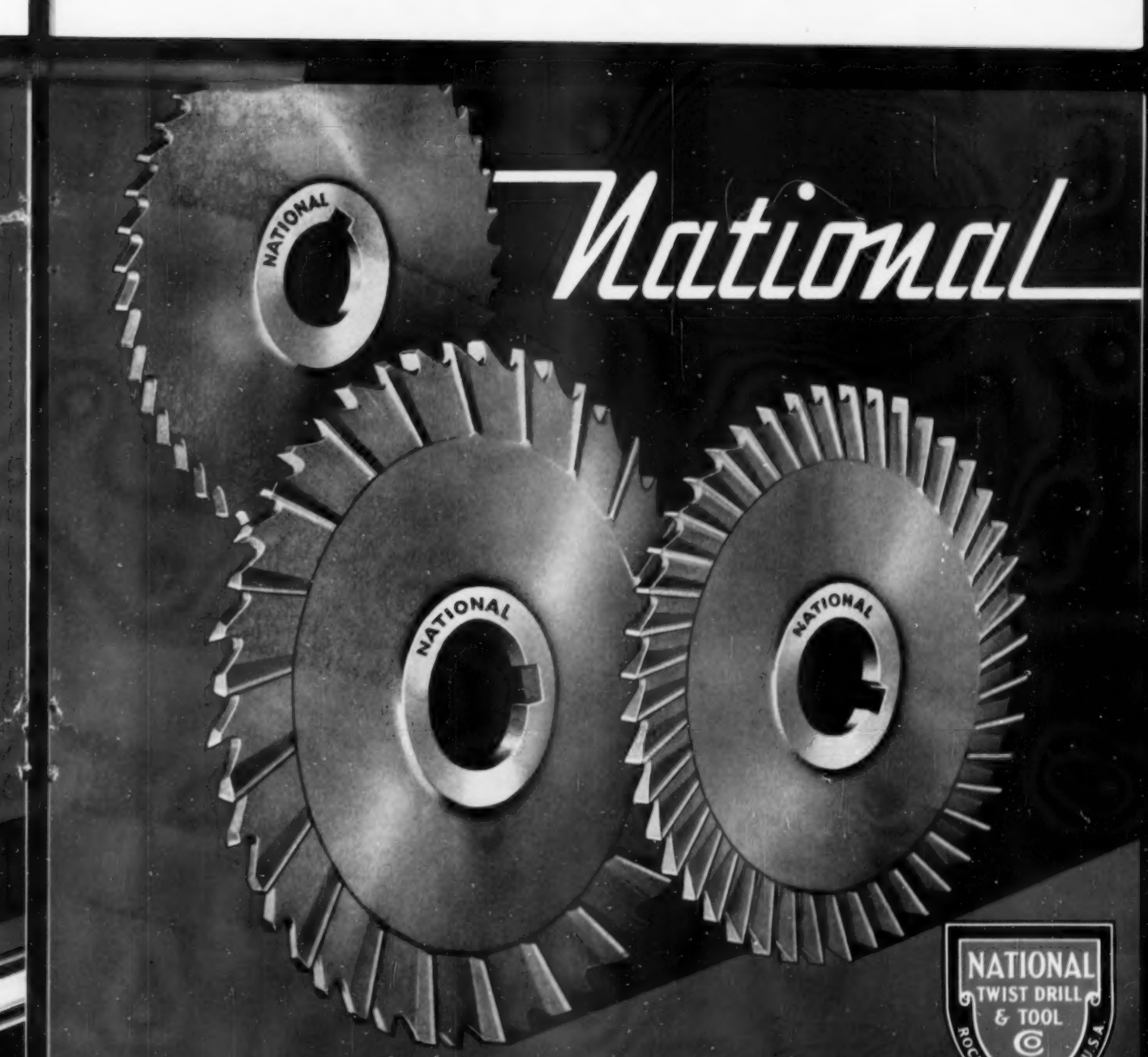

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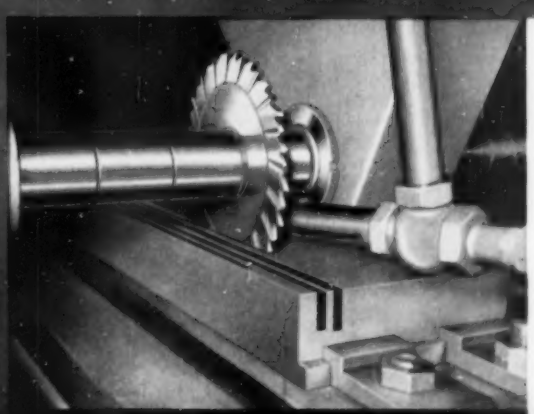

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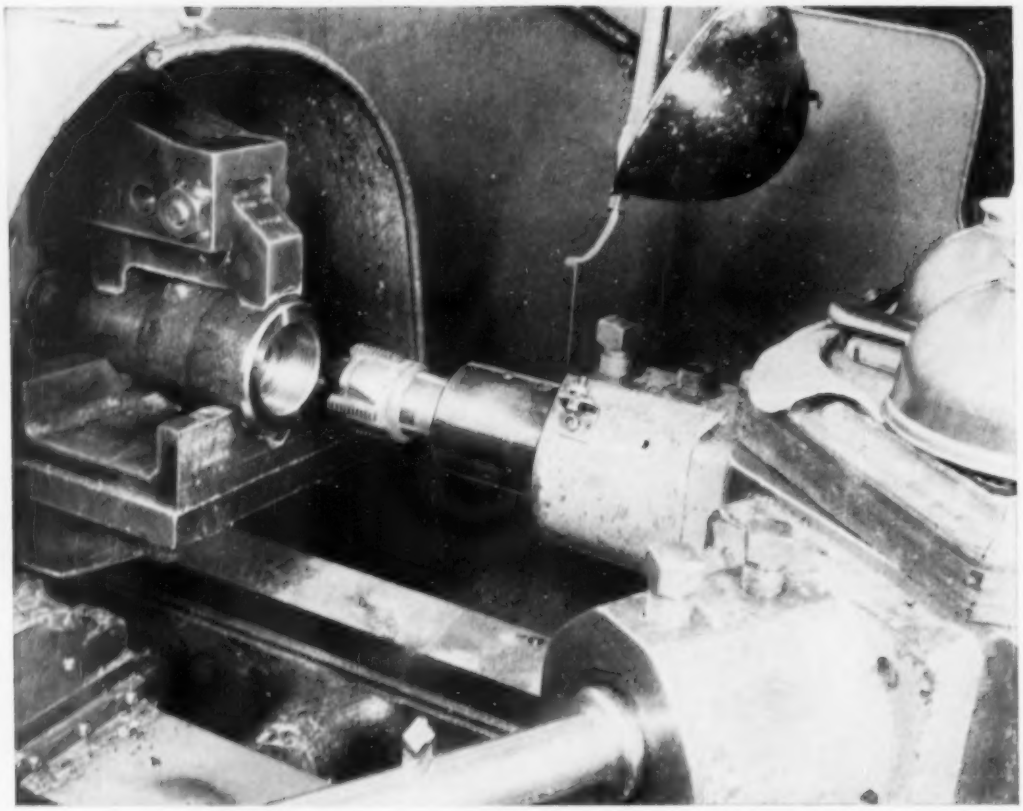

TWO LANDIS Solid Adjustable Taps interchanged to thread valve body

Both taps are used at the same turret station (since others are required for additional tooling) —each shank has an open keyway for securing the tap in turret position to facilitate interchange. The low cost LSA Tap is also ideal for this type of operation where the small number of workpieces does not justify a Collapsible Tap.

In the first operation (illustrated—at the Fisher Governor Company in Marshalltown, Iowa), a 2½" LSA Tap produces 2½" 8-pitch UN threads of excellent quality $1\frac{3}{8}$" long at 23 SFM. In the interchange, a 1¾" LSA Tap produces a 1¾" 12-pitch UN thread $\frac{9}{16}$" long on the same workpiece. Both threads are cut to Class 2B fit on the WCB 1020 steel bodies with approximately 150 pieces completed before regrinding the chasers.

LANDIS Solid Adjustable Taps supplement the regular line of LANDIS Collapsible Taps, and are available in 15 sizes to tap diameters from $1\frac{1}{16}$" to 9". They feature infinite size adjustment within the range of each tap, and are rigidly constructed with all parts subject to wear nitrided after heat-treating. Through the use of LANDIS Tap Chasers, threads of excellent finish are produced with minimum tool cost. For more information, ask for Bulletin G-92.

481

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a money making virtue!

This time saving feature of "AMERICAN" Pacemaker Lathes appeals strongly to operators who acclaim it a real money maker for them.

The speed plate is direct reading and shows at a glance the available spindle speeds and how to secure them. Operators can't go wrong. So fast, so easy to read and so simple that they do not hesitate to make speed changes to secure correct cutting speeds.

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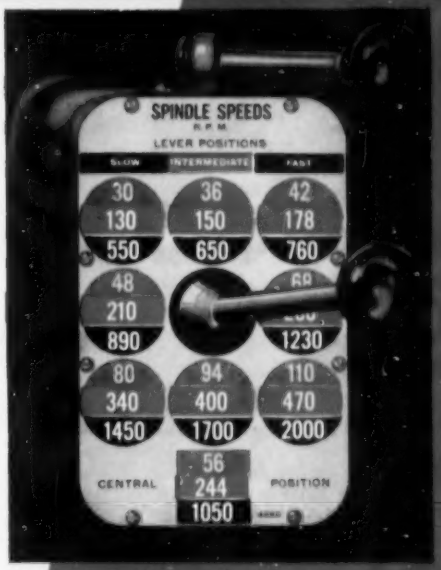
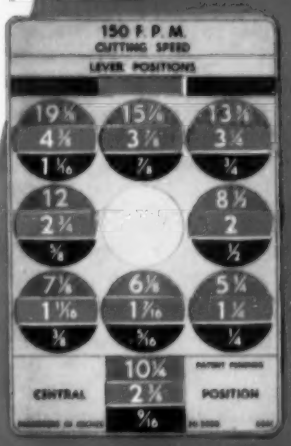
No system for securing cutting speeds could be simpler, faster or less expensive in first cost and maintenance.

- *These and other fine features of the "AMERICAN" DeLuxe Model Pacemaker are illustrated and described by Bulletin No. 116.*



Spindle Speed Plate (Direct Reading)



Cutting Speed Plate (Direct Reading)

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LATHES AND RADIAL DRILLS

ERGONOMICS

"designs" the operator into all Warner & Swasey Turret Lathes

Result: Increased Production

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Warner & Swasey designers know that maximum lathe production is obtained only when operators like the equipment with which they work. So, by taking into account human abilities and limitations, they "ergonomically" design turret lathes which provide you:

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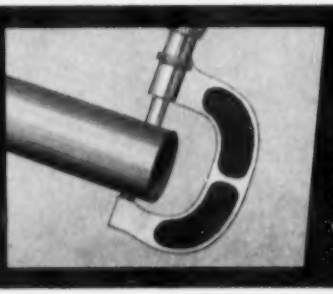
Accurate Machines for worriless production over a long period of time with minimum maintenance.

Individually designed machine sizes and types so the machine is neither too big nor too small for the job range.

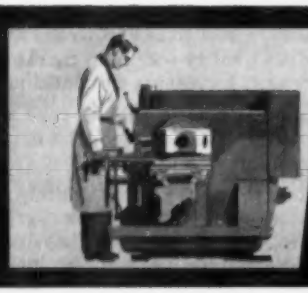
Operators are more content, their output increases and best of all, *your* profits rise when you put Warner & Swaseys on the job.

The direction in which an operator must move a lever has an important bearing on the strain involved and speed of accomplishment.



Accurate machines put relaxation and enjoyment into your operator's work day...eliminating the constant fight to hold tolerances and avoid scrap.

YOU CAN PRODUCE IT BETTER.



When jobs are matched to the machine size, operators stand closer to the work, handle the machine easier, and put more pieces on the floor for you.

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PRECISION MACHINERY SINCE 1880

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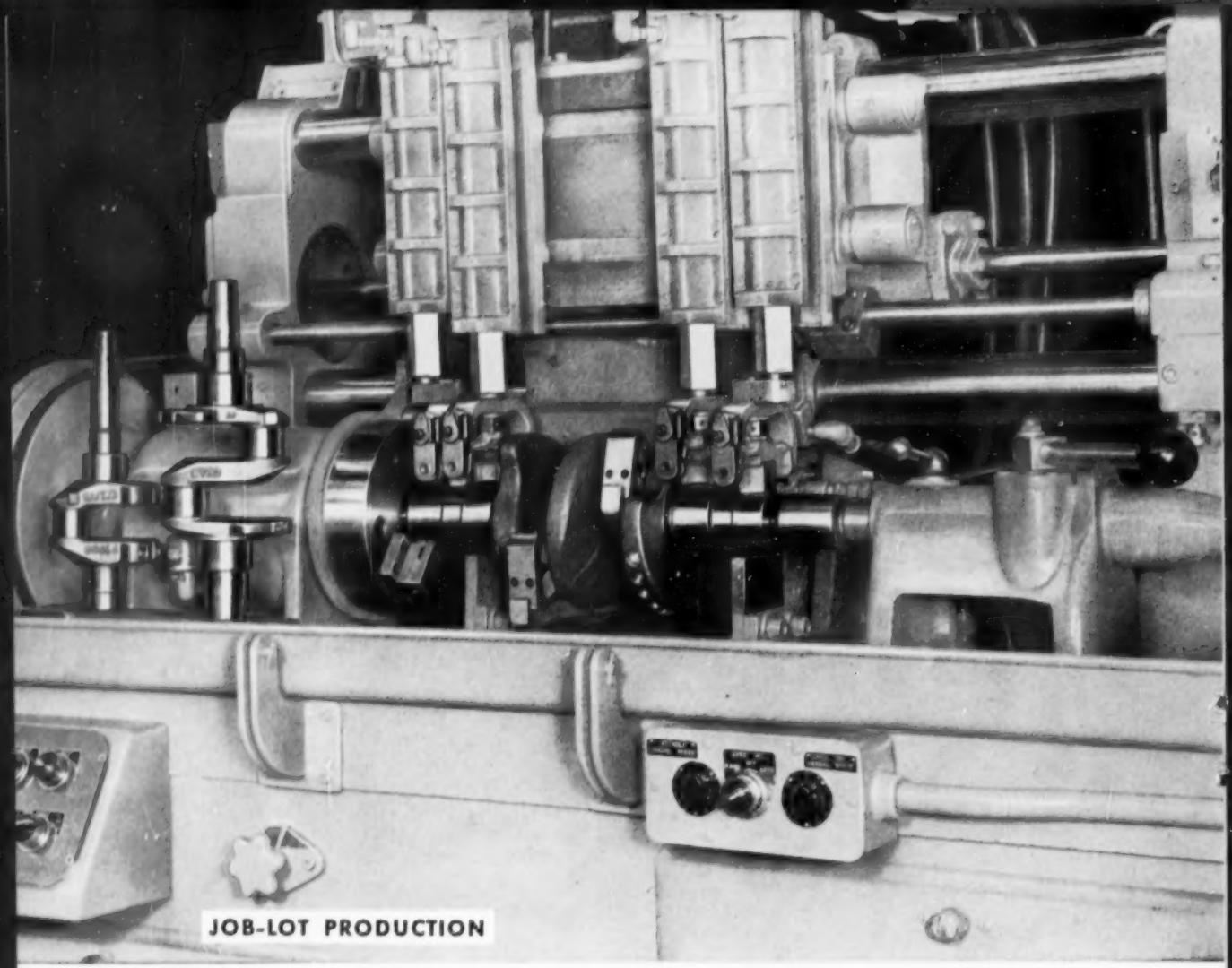
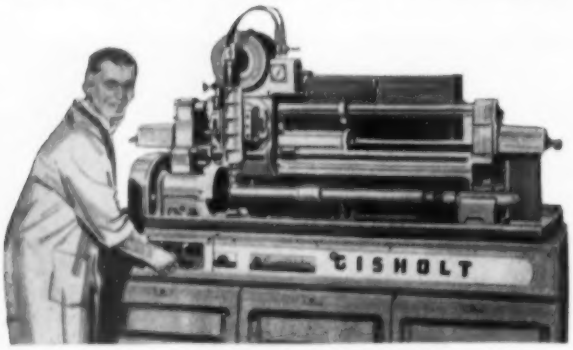


No. 51A General Purpose Superfinisher

CRANKSHAFTS in small job-lots are Superfinished with this setup—holding the piece between centers and driving from a keyway with a faceplate driver. Latch-on follower-type arms Superfinish the crank pins, while the main bearing and oil seal surfaces are Superfinished by standard overhead quills. Main and pin bearings are taken from a ground surface of 30 micro-inches down to 8 or less. Oil seal surfaces on shaft ends are Superfinished to 4 or less. Production: 44 to 53 pieces per hour at 80% efficiency.

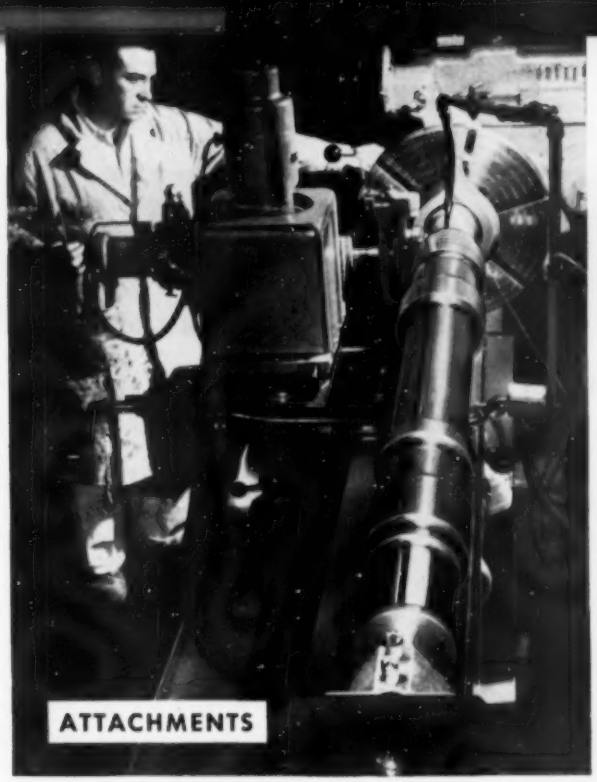
NEED SMOOTHER SURFACES AT LOW COST? See the



BEEN LOOKING FOR AN INEXPENSIVE PROCESS to improve product quality—to help market your product easier against increasing competition?

Gisholt Superfinishing may well be your answer ...it has been for some time for a long list of leading manufacturers.

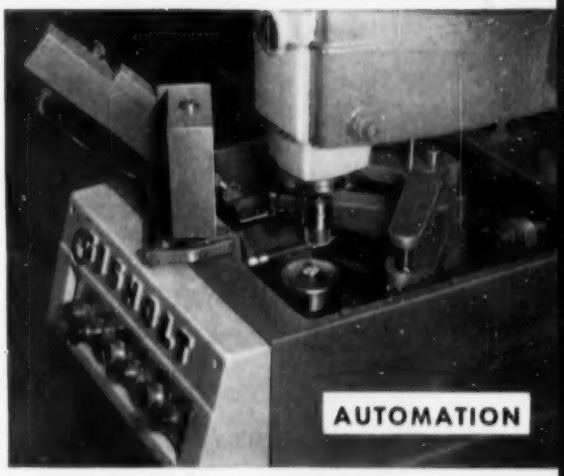
With this modern process, you'll definitely reduce —or even eliminate—the cost and time of grinding, polishing or buffing operations. With the exclusive Gisholt Superfinishing method, you utilize a "scrubbing" effect through an abrasive stone which oscillates as the work rotates. Chatter marks, grind-



No. 4 Superfinisher Attachment

AXLE JOURNALS for railroad switchers are Superfinished with No. 4 Attachment on Gisholt Saddle Type Turret Lathe in this operation. In three steps, lathe finish of 200-250 micro-inches RMS is reduced to final surface finish of 8-10 RMS, removing .004" to .005" stock to eliminate tool marks. Through Superfinishing, 25 switchers logged 30,000 trouble-free hours on journals in first few months.

Superfinished tappet with .005-inch crowned top.



No. 81 High Production Superfinisher

CAST IRON VALVE TAPPETS are Superfinished in long runs on this job, featuring fully automatic handling with a work transfer device. Cup-shaped stones are used, Superfinishing from flat ground surface down to 5 micro-inches RMS or less—and rotating off center to generate .005" crown on the cam end of each tappet. In only 16 seconds floor-to-floor time per piece, the valve tappets are economically Superfinished for longer wear life and better product quality.

NEW GISHOLT MASTERLINE SUPERFINISHERS

ing flats, and amorphous "smear" metal left by grinding are completely removed. The true base metal is exposed—providing longer wear and better performance from your product.

Better still, most Superfinishing jobs are done in a fast, automatic cycle—producing very low micro-inch surface readings in the shortest possible time.

The jobs shown here are typical examples where Superfinishing solved production problems and improved product quality. Ask your Gisholt Representative to tell you about them—and many more—in full detail. Call him today!

WRITE TODAY for 30-page illustrated booklet "Superfinishers," explaining Gisholt Superfinishing process in interesting detail.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

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Madison 10, Wisconsin, U.S.A.

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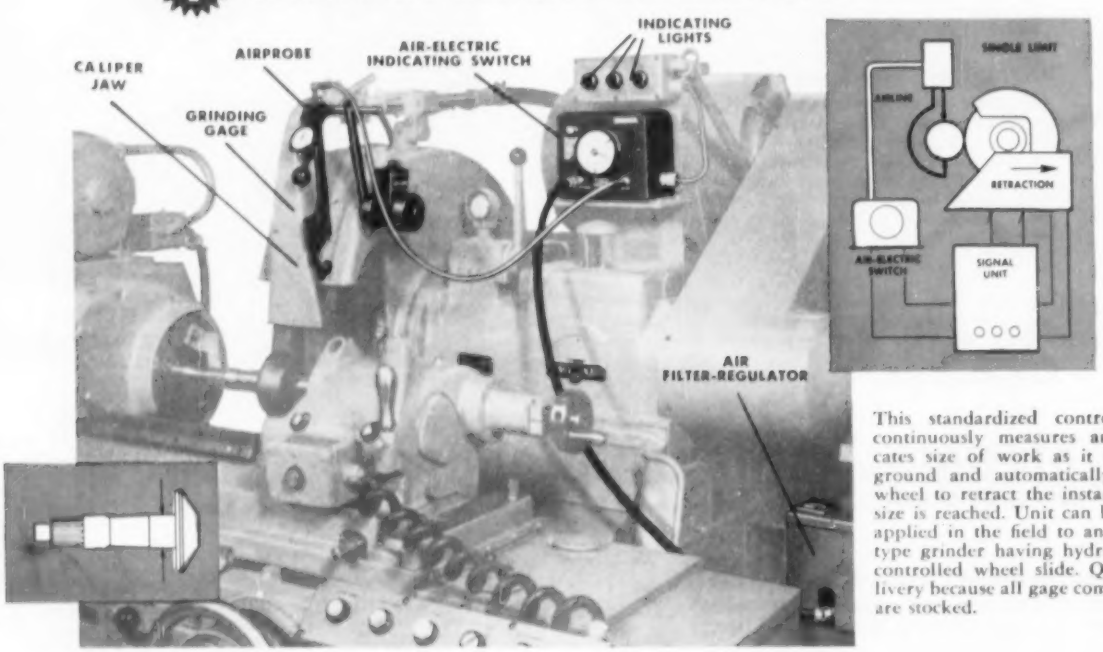
Profit margins aren't getting any better . . . just the opposite. With buying appetites fairly well satisfied, it's no longer a matter of "getting the stuff out". The problem now is making it *better at lower cost.* You certainly don't plan to let competition catch up to you. So consider these ways of improving product quality and, at the same time, cutting down on the cost per piece. Advanced gaging — by FEDERAL — can do it. The gaging ideas are proven profit makers. The gages, far from being monsters of automation, are compact, standardized units, realistically designed to provide automatic control or inspection, or both, where it does the most good and at a price that practically *every* manufacturer can afford. And they have reliability . . . the most important single feature of FEDERAL Gaging.

Whether you're big or small in terms of production, ***at least one of these gaging arrangements can pay off for you.*** *It's the truth. Ask us to prove it. Write:*

FEDERAL PRODUCTS CORPORATION
7198 Eddy Street, Providence 1, R. I.

1 AUTOMATIC CONTROL OF FINISH SIZE



This standardized control gage continuously measures and indicates size of work as it is being ground and automatically causes wheel to retract the instant finish size is reached. Unit can be easily applied in the field to any center type grinder having hydraulically controlled wheel slide. Quick delivery because all gage components are stocked.

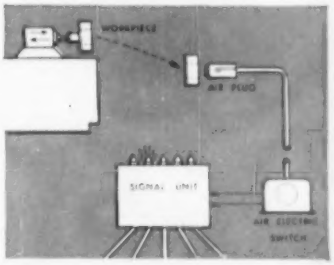
BENEFITS: *Reduces cost of operation — permits one operator to handle two, possibly three grinders performing the same or different operations. In this way gages pay for themselves within a few months.*

Improves quality — even if you have only one grinder, gage is a profit-maker because it eliminates error due to operator inattention or fatigue and also eliminates cost of later inspection. Gage never tires, is accurate to .0001" or better, is easily adjustable to control different sizes of work. Its Air-Electric system overlooks minor workpiece surface irregularities which confuse size readings of other gages.

VARIATIONS: *Similar FEDERAL Gages are available through machine tool manufacturers to also change wheel feed rate to dwell grind . . . or to control dressing cycle and finish size on I.D. grinders. When specifying machine tool requirements be sure to include* FEDERAL *Gaging.* FEDERAL *maintains close engineering alliance with all leading machine tool manufacturers.*

AHEAD OF COMPETITION

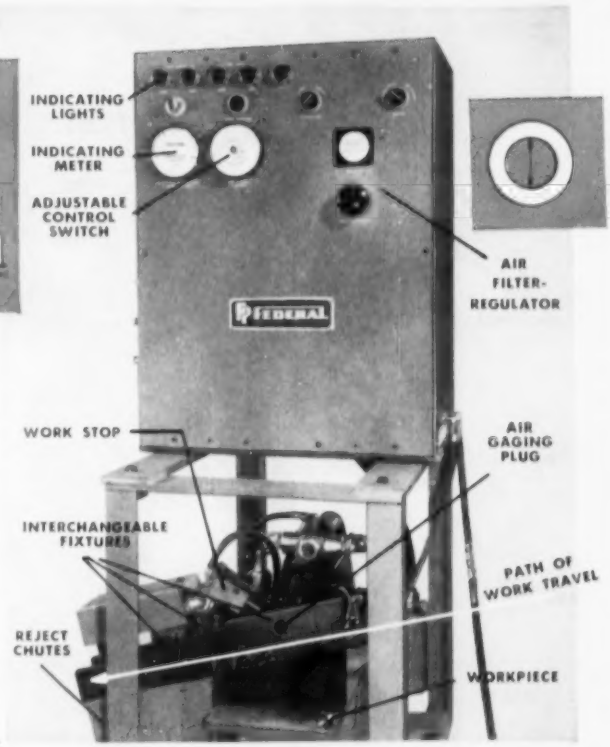
2 AUTOMATIC 100% INSPECTION

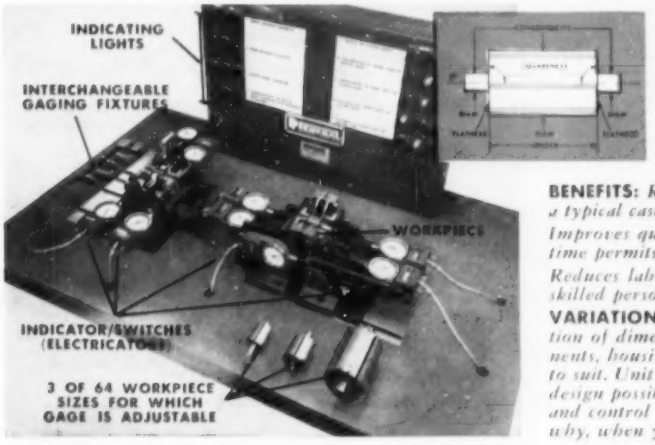


This standardized "post-process" gage inspects every part as it is discharged from the machine and sorts work into "good", "near-over", "near-under" plus "salvage" and "scrap", indicating the size of each piece as it is gaged. Operator, watching large indicating lights, can compensate machine for drift and piece-to-piece variation *before any scrap parts are produced.* Unit can be applied to any type I.D. or O.D. grinder, lathe, boring machine or screw machine. Gaging fixtures can be made interchangeable to handle various work sizes.

BENEFITS: *Lower cost per part. Gage virtually eliminates scrap by showing trend before tolerance limits are reached. Eliminates inspection errors — gage has 99.8% reliability or better as compared to about 92% for operator inspection and about 85% for inspection by other personnel.*

VARIATIONS: FEDERAL *Gages of similar type are available through machine tool manufacturers to also provide automatic compensation of the machine, either proportionally or by increments, so that drift is corrected without need for operator attention. Moral: To get the maximum return for your investment, be sure to specify* FEDERAL *Gaging when you're buying machine tools.*





3 SEMI-AUTOMATIC, MULTIPLE DIMENSION MEASUREMENT

Ideal for small and medium production manufacturers, this gage checks nine dimensions in two stations and is adjustable for 64 different sizes! Work is loaded and disposed of manually. Lights show "good", "over" and "under". Units like this one have paid for themselves in well under six months.

BENEFITS: *Reduces non-productive costs — inspection time per part, in a typical case, is reduced 75%.*

Improves quality level. Inspection error is eliminated. Greatly reduced time permits profitable 100% inspection instead of sampling.

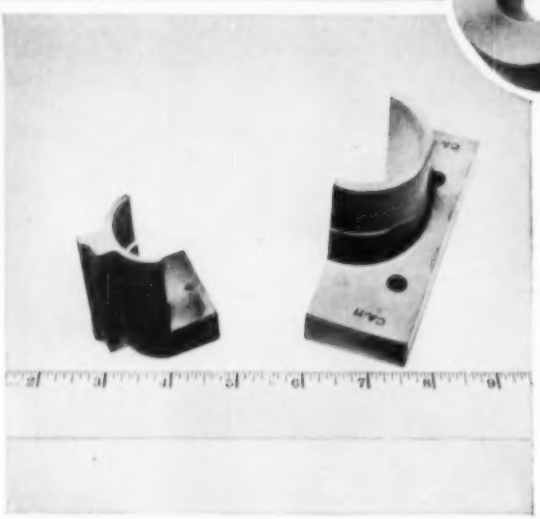
Reduces labor cost. Inspection can be performed satisfactorily by less skilled personnel.

VARIATIONS: *Unit can be designed to provide virtually any combination of dimensional measurements. Sensing elements, electrical components, housing and base are standardized. Other components designed to suit. Unit can incorporate semi-automatic disposal. Number of other design possibilities all the way up to a completely automated inspection and control gage. In every design the emphasis is on reliability. That's why, when you buy* FEDERAL *Gaging, you buy results.*

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



Look How You Can Save with PREFORMED CARMET®

DIE SECTIONS

these Blanks are preformed to a Finishing Allowance of .018"-.022" per side

Write for Your Copy:
CARMET CATALOG

Just out . . . 32 well-illustrated pages, containing data on all Carmet grades, and on Carmet blanks, tools, die sections, punches, draw die inserts, etc.; also special preforming to order. ● *Write for your copy.*

ADDRESS DEPT. TE-92

These tungsten carbide die sections are of Carmet CA-11, a special grade developed expressly for punches, dies, and other heavy shock applications where wear and abrasion resistance are required.

These blanks have a span of 1.315" with a wall thickness of only .046", but they were easily produced to close tolerances by AL's precision preform methods. All surfaces are clean, smooth and free from defects, requiring only a minimum amount of grinding to final dimensions.

Carmet carbides can be accurately produced to practically any shape or size your designs may require, and can be supplied preformed as desired. Typical highly successful applications include inserts for drawing, heading, extruding and blanking dies; gauge and wear parts; pins; bushings; etc.

Find out, TODAY, how you can cut costs with preformed Carmet. Write or call *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda and Jarvis Avenues, Detroit 20, Mich.*

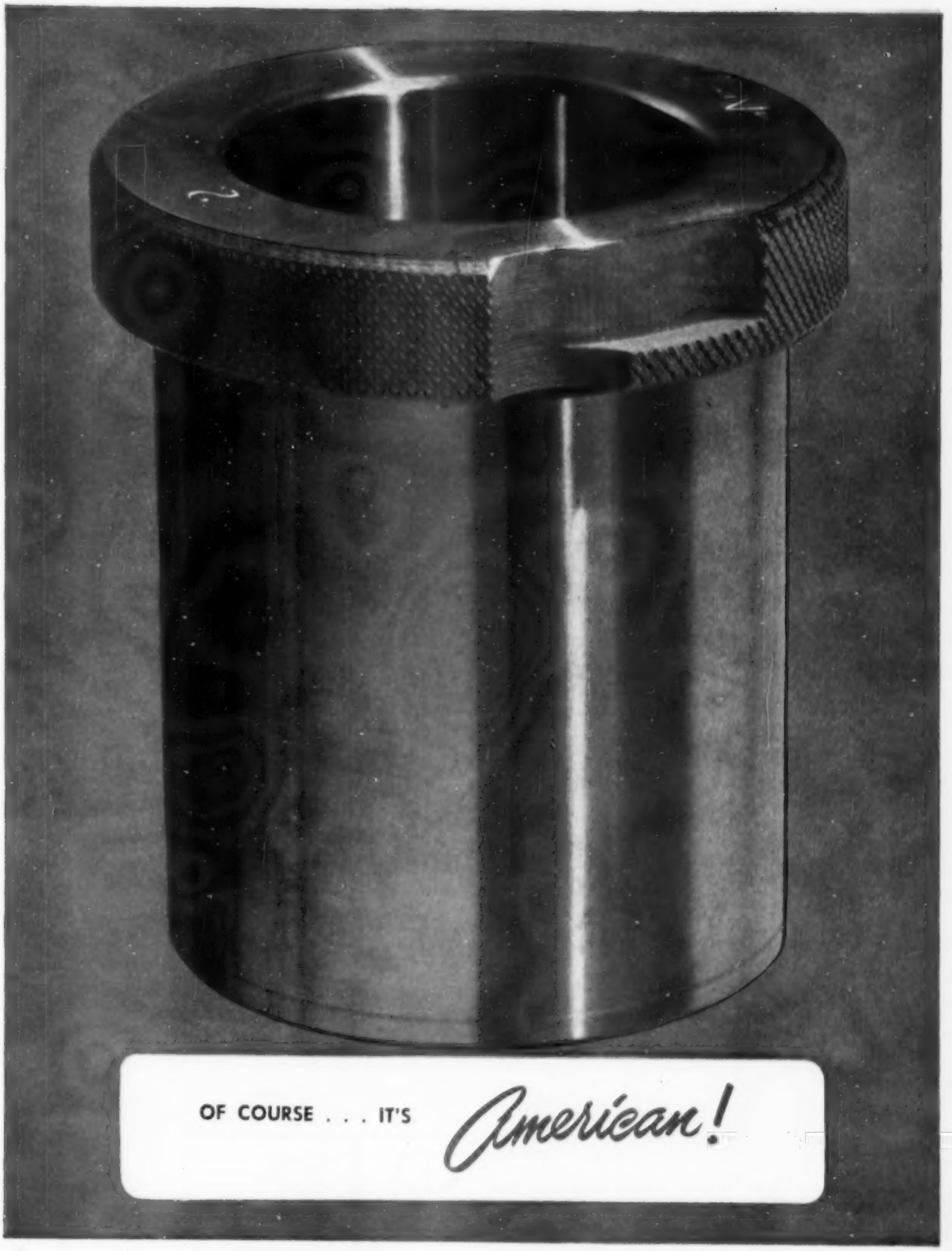
For nearest representative, consult Yellow Section of your telephone book.

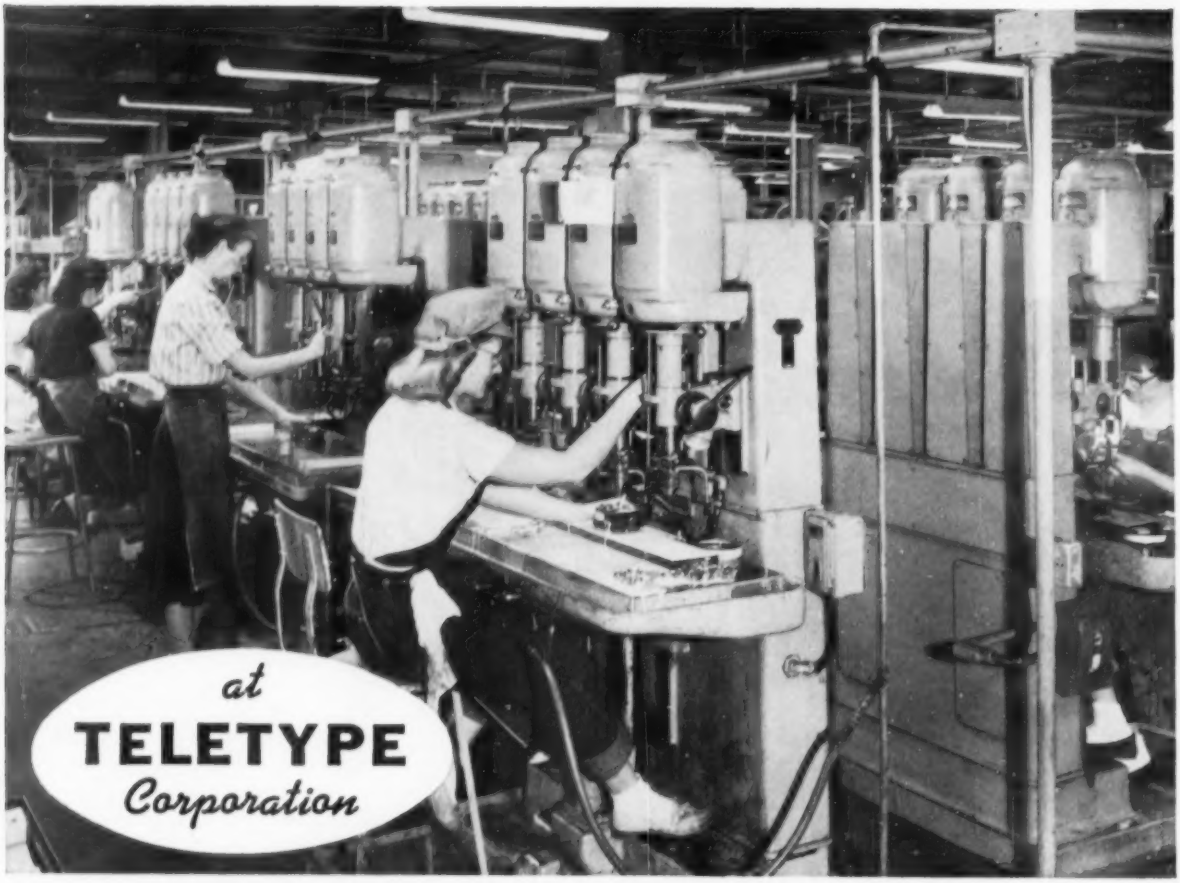
For ALL your CARBIDE needs, call

Allegheny Ludlum

WSW 6636

AL® FINE TOOL STEELS SINCE 1854


OF COURSE . . . IT'S American!



Women Work Well with LELAND-GIFFORD Drilling Machines

At the dexterous finger touch of skilled women operators, these rugged he-man Leland-Gifford Drilling Machines perform miracles of precision drilling for Teletype Corporation.

Thousands of small precision parts for intricate Teletype machines require a wide variety of precision drilling operations — drilling through or to depth, tapping, countersinking, spot facing.

Batteries of Leland-Gifford Multiple Spindle Drilling Machines provide the extreme sensitivity plus infinite flexibility needed to handle these operations quickly, accurately and profitably. The right tools are always ready for use in the right sequence and combination. Work moves smoothly from one spindle to the next, requiring a minimum of handling even for the most complex pattern of holes.

Walk through the plants of the nation's foremost producers of precision work and you'll find one name more than any other on precision drilling equipment — LELAND-GIFFORD. Leland-Gifford Multiple Spindle Drilling Machines are available in a complete family of sizes in a wide range of swings, number of spindles, types of feed. New bulletins give complete information. Write for them.

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LOS ANGELES OFFICE
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Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

M & M develops another specialized machine

New automatic inline transfer machine

handles 650 pistons per hour at 100% efficiency

Pistons are delivered to the first station of machine by a conveyor. They are picked off this conveyor, loaded into the machine, processed and delivered to another conveyor . . . all automatically. Here is the sequence of operations performed:

Station 1—Accept and unload piston from conveyor chute.

Station 2—Orient piston in relation to pin bores and bosses, using an electric eye and orientating table.

Station 3—Push piston down against positive locator by means of hydraulic expanding lug. Drill center of dome end and spot face two sections from the bottom upwards.

Station 4—Mill weight pads.

Station 5—Spot drill drive holes in weight pads.

Station 6—Drill drive holes in weight pads.

Station 7—Ream drive holes in weight pads.

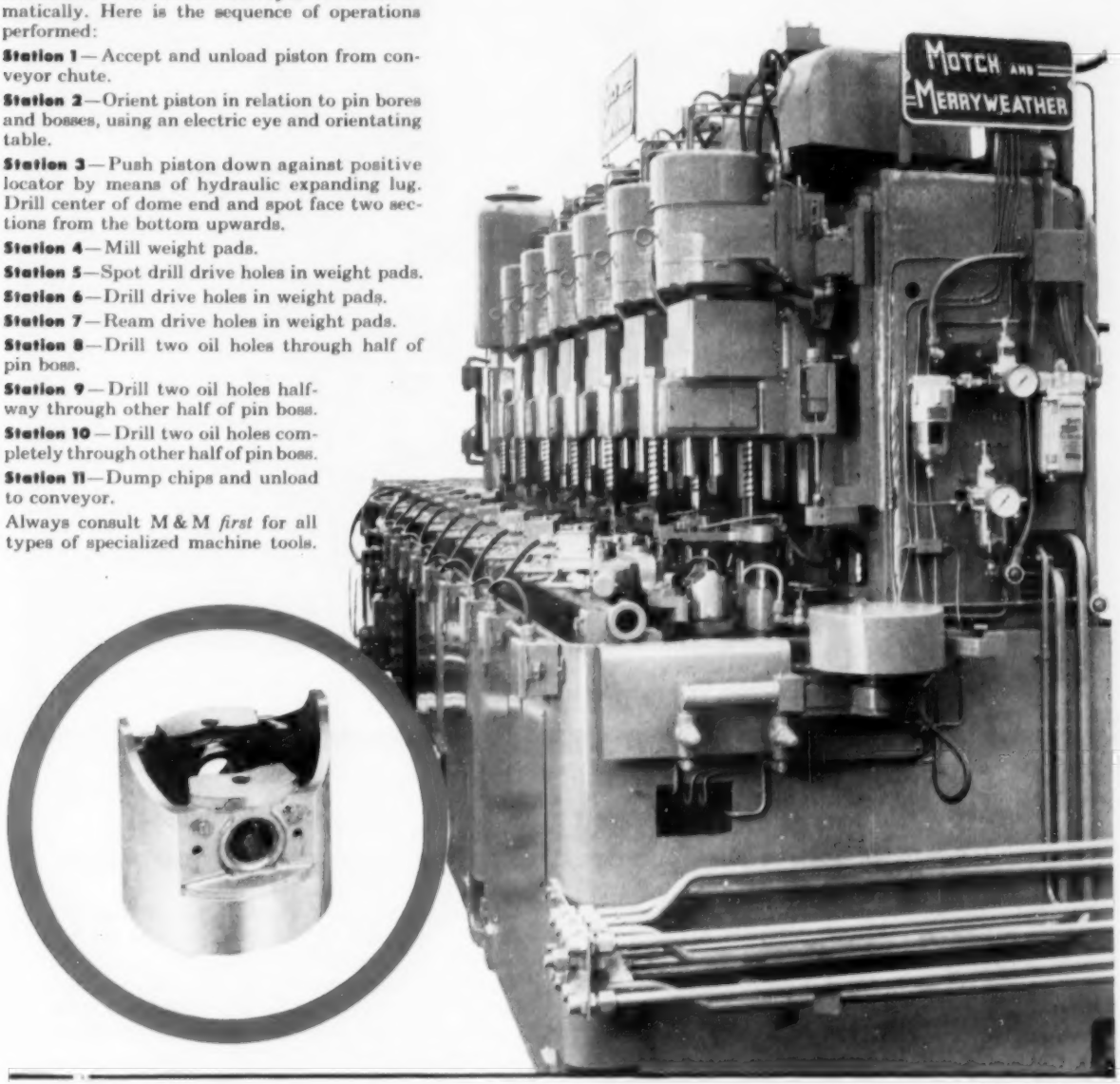
Station 8—Drill two oil holes through half of pin boss.

Station 9—Drill two oil holes halfway through other half of pin boss.

Station 10—Drill two oil holes completely through other half of pin boss.

Station 11—Dump chips and unload to conveyor.

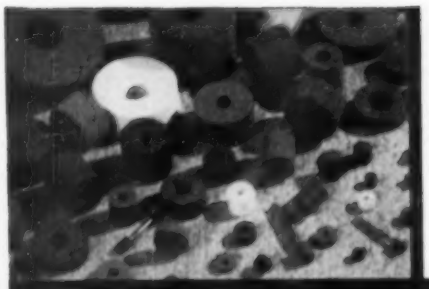
Always consult M & M *first* for all types of specialized machine tools.



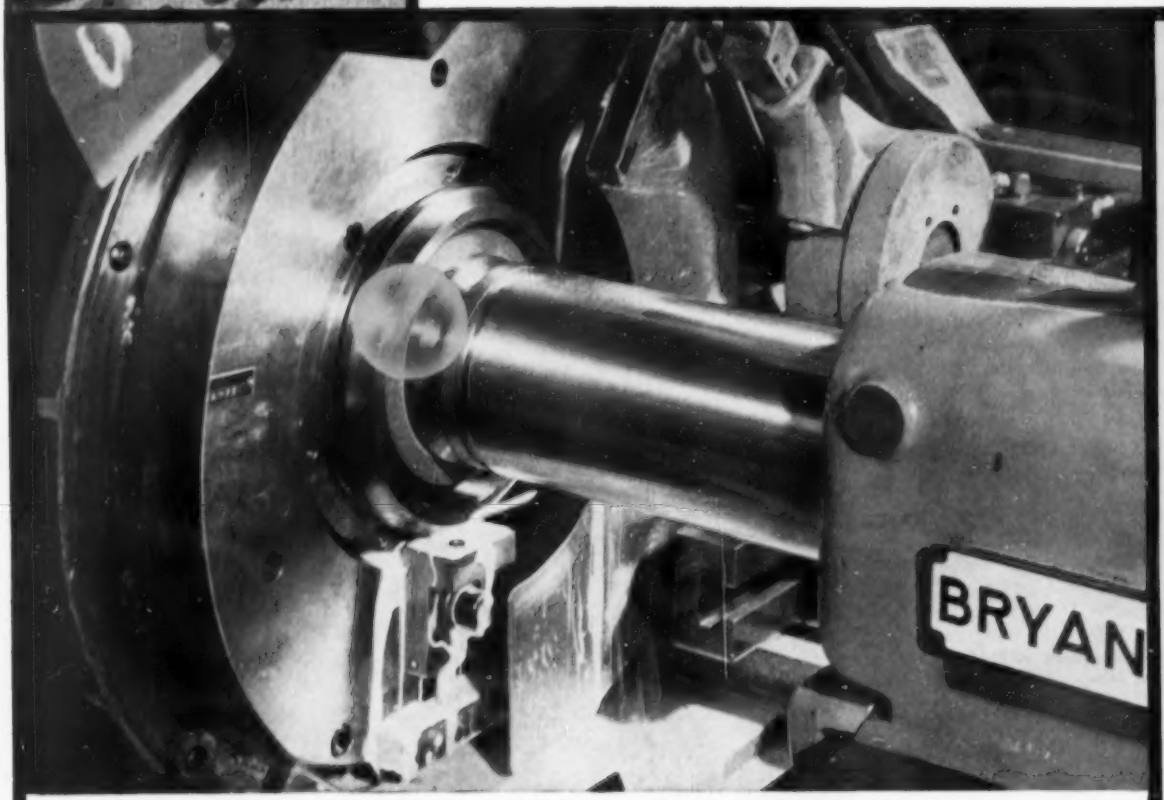
The **MOTCH & MERRYWEATHER MACHINERY** Company

MACHINE TOOL MFG. DIVISION
CLEVELAND, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-19



Best for every



High Production At Lowest Cost. Norton wheels for internal grinding are precision-processed for completely uniform structure and identical top performance. There's no fussing with timing cycles when you change wheels.

Norton wheels — with different abrasives, different bonds — spread the "Touch of Gold" across the entire internal grinding range

You can step up your production rate on internal grinding jobs by choosing exactly the right Norton I.D. grinding wheel you need. And you'll add the "Touch of Gold" to your product quality as well as quantity — because you have the widest possible choice.

For high production grinding, 44 ALUNDUM*, 57 ALUNDUM, 19 ALUNDUM and regular ALUNDUM abrasives are all quality abrasives at non-premium prices. In particular, the new 44 ALUNDUM wheels with G Bond have earned high praise from users in many different types of applications. For example:

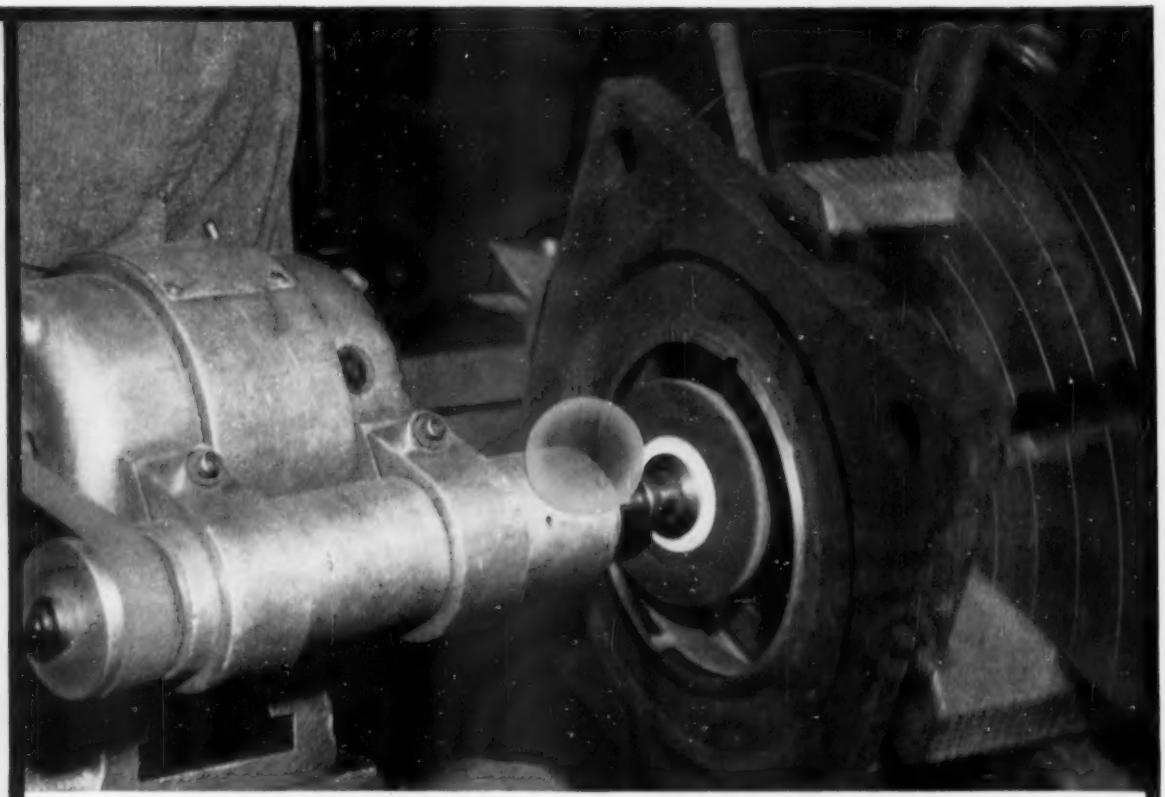
A Michigan customer, using 44 ALUNDUM wheels for I.D. grinding heavy duty hardened steel bushings, reports: *Breakdown was very even, with less glazing, excellent cutting action, and half the dressings needed by standard wheels. "44's" were the best ever used.*

From a New Jersey user the report on internal grinding of small steel gears is: *The "44's" are great for grinding sharp radii, with 30% more pieces per dressing and per wheel, and finish improved from 28 to 15 r.m.s.*

In a California plant, doing all kinds of internal grinding the details are: *Best all-around wheels ever used. Top performance on stainless steel, cutting exceptionally fast without excessive breakdown.*

A Pennsylvania customer, internal grinding steel gear housings, says "44's" are: *Freer cutting wheels that hold*

I.D. grinding job you do



Money-Saving Precision In Toolroom And Miscellaneous Internal Grinding is assured by the completeness of the Norton line — the right abrasive and bond for every type of job on every type of grinder.

W-1819

form better, require less dressing and greatly improve finish.

Whichever of these abrasives you use, team it up with the Norton G Bond, the most efficient vitrified bond ever developed for accurate production grinding.

When your I.D. grinding is the toolroom type, choose 38 ALUNDUM or 32 ALUNDUM abrasive — the latter especially for the more-difficult-to-grind steels because of its outstanding ability to penetrate and hold the cut. And with these two famous abrasives, select G or BE bonds — both vitrified.

Your Norton Distributor will gladly arrange a test of these "Touch of Gold" wheels in your plant. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS

Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:

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40 STYLES—OVER 200 TOOLS—

MAKE KENDEX* TOOLING ADAPTABLE

for virtually every machining job

The production-boosting, cost-cutting, job-simplifying advantages offered by the Kendex throw-away, turn-over insert principle can be adapted to practically any machining job.

Over 40 styles and over 200 Kendex tools let you make savings in boring; profiling; chamfering; odd job, step and face milling . . . on older machines as well as on the newer automatic cycling types.

Kendex tools permit quick changing of inserts without resetting the tool, eliminate costly insert and chip-breaker grinding, give better chip control, permit use of harder grades like Kennametal K7H along with many other grades in inserts of various sizes and shapes to give best results on any specific job. Many of the tool styles offer a choice of positive or negative rake which accommodate either regular or precision ground inserts. Kendex offers the most advanced and complete line of metalworking tools available today.

The pictures above merely suggest the many tools in which the Kendex principle is available. Your Kennametal Tool Engineer will help you apply Kendex tools to your operations. He works exclusively with Kennametal tooling . . . applying and servicing it . . . working with production men in mapping the best solutions to tough machining problems. Give him a call or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

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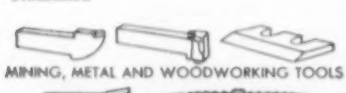

MINING, METAL AND WOODWORKING TOOLS

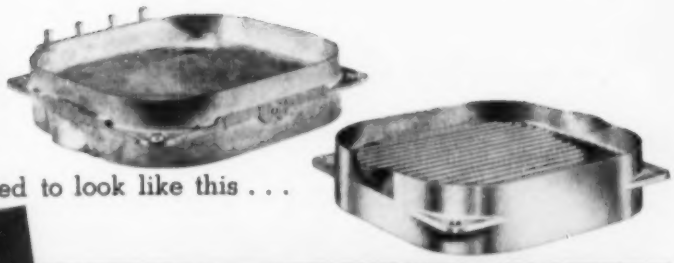
WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND
KENNAMETAL
. . . Partners in Progress

ABRASION, CORROSION-RESISTANT PARTS

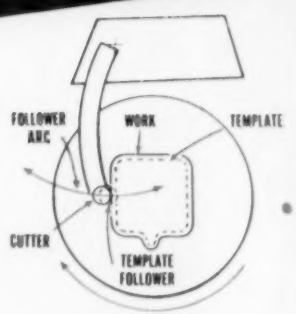
PERCUSSION AND IMPACT PARTS

when you have parts of aluminum or other nonferrous metals . . .



that must be side, face or contour milled to look like this . . .

You can do the job better, far faster and at much less cost with an Onsrud® **ROTARY FEED HIGH SPEED MILLING MACHINE**



Guide roller mounted on pivoted arm follows template, moves to any point of follower arc to vary cutter head position as required, as table rotates to feed work through complete milling cycle.

Here is one of several Onsrud Rotary Feed Milling Machine models . . . a design type that has become the most versatile and productive in metal milling. The kinds of production parts that can be milled to advantage are almost endless in number . . . wherever the operation involves straight line or contour side milling or horizontal top-edge milling. The A-50AE machine shown here has a capacity for work up to 40" diameter. A high speed milling head with Onsrud two speed 7½/3¾ HP, 3600/1800 RPM air cooled motor gives proper cutter speed for fine finish and rapid feed. Other models supplied to fit work requirements as needed.

Write for Information

Let us tell you how Onsrud Rotary Feed Milling Machines can lower your production costs . . . in aluminum and related nonferrous milling. We'll also be glad to give you information on all other Onsrud milling machines for every type of production milling. Your inquiry is cordially invited.

WORK SET-UPS LIKE THESE . . . PART OF THE PRODUCTION ADVANTAGES OF ONSRUD ROTARY FEED MILLING

ALL FOUR SIDES IN ONE SET-UP
Work held by pneumatic center clamp, for milling completely around the part if desired.

CONTINUOUS PRODUCTION
Work fixture built with two, three or four (or more) stations for continuous feed of work to cutter. Operator merely loads and unloads without production time loss.

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7726 LEHIGH AVENUE (SUBURB OF CHICAGO) NILES 11, ILLINOIS

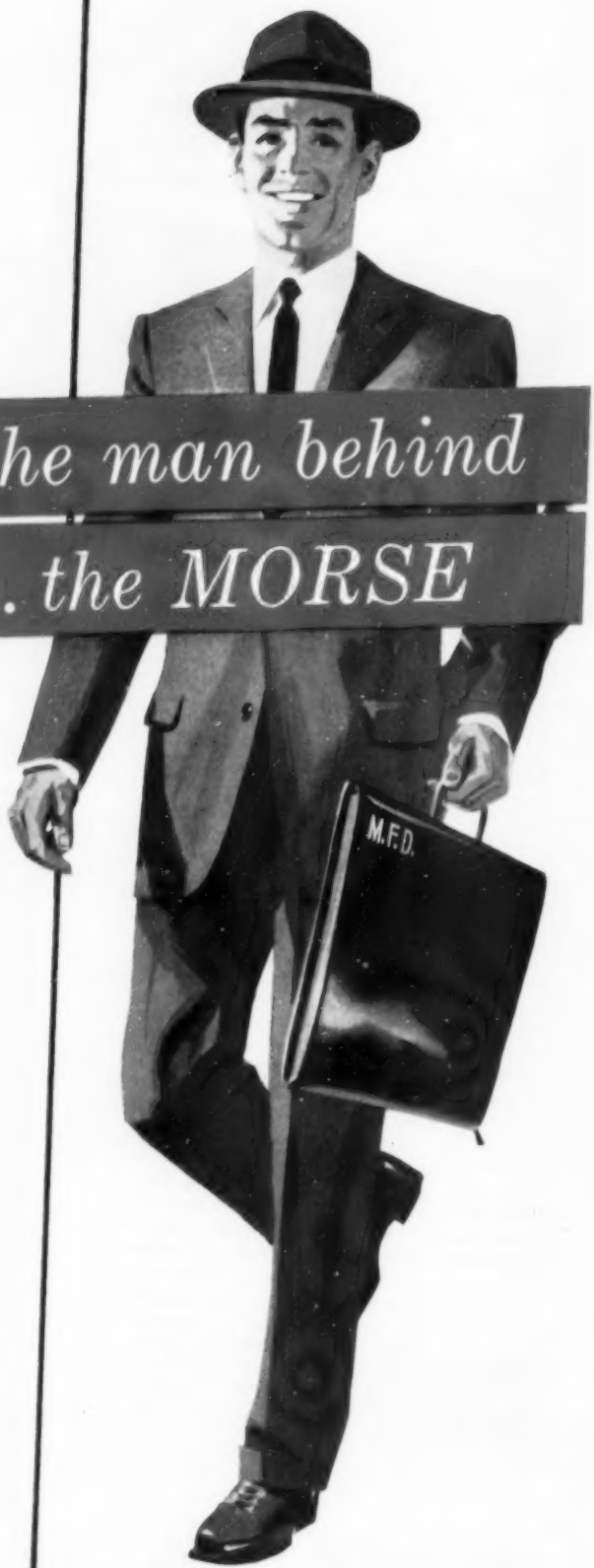
Onsrud® High Speed MILLING MACHINES for Aluminum and Related Nonferrous Metal Milling

For doing things *better* by doing things *differently!*

Your friend
indeed
when you're
in need...

the man behind the man behind

...the MORSE



Morse Designers...

Morse Engineers...

Morse Modernized Plant...

Morse Master-Craftsmen...

all backing up

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New Bedford, Mass.

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Warehouses in
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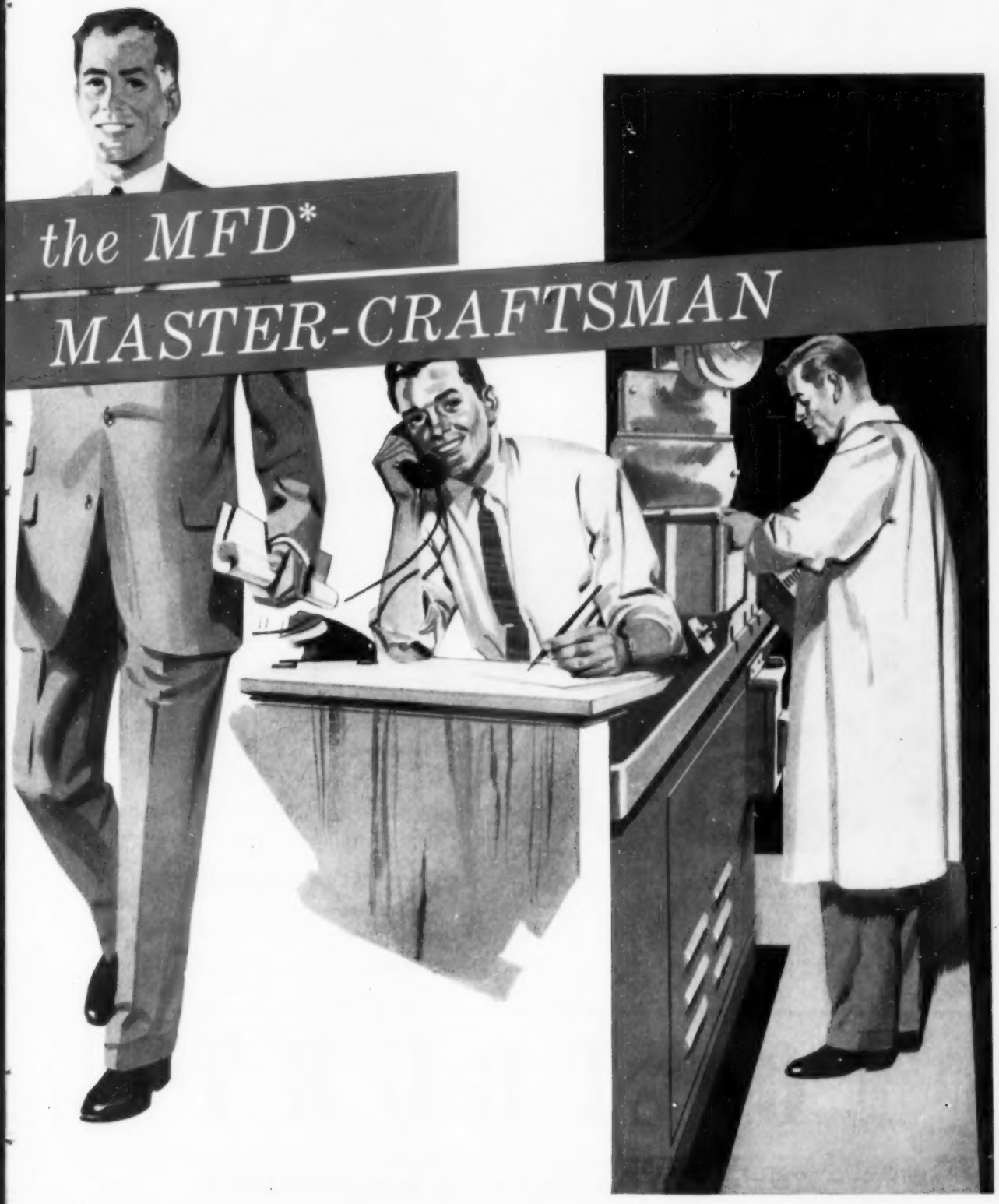
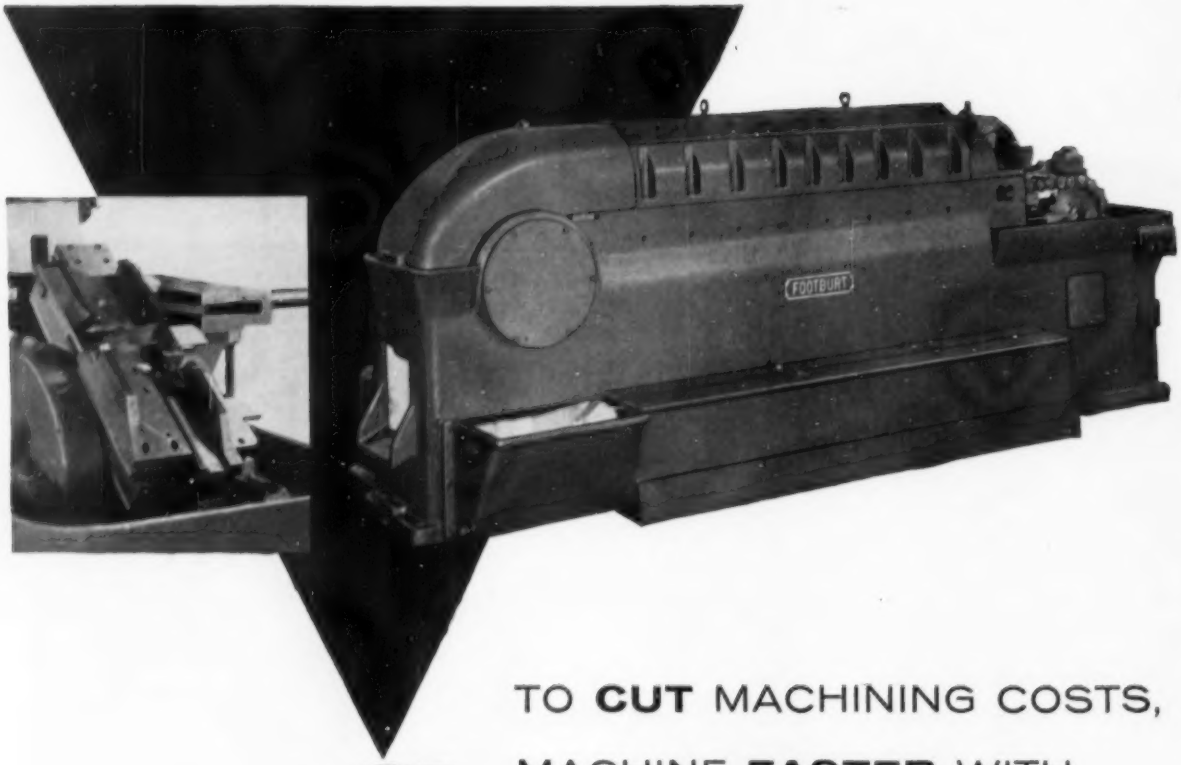

the MFD*
MASTER-CRAFTSMAN



TO **CUT** MACHINING COSTS,

MACHINE **FASTER** WITH

Continuous broaching

Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY

Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

Write for Circular No. 503

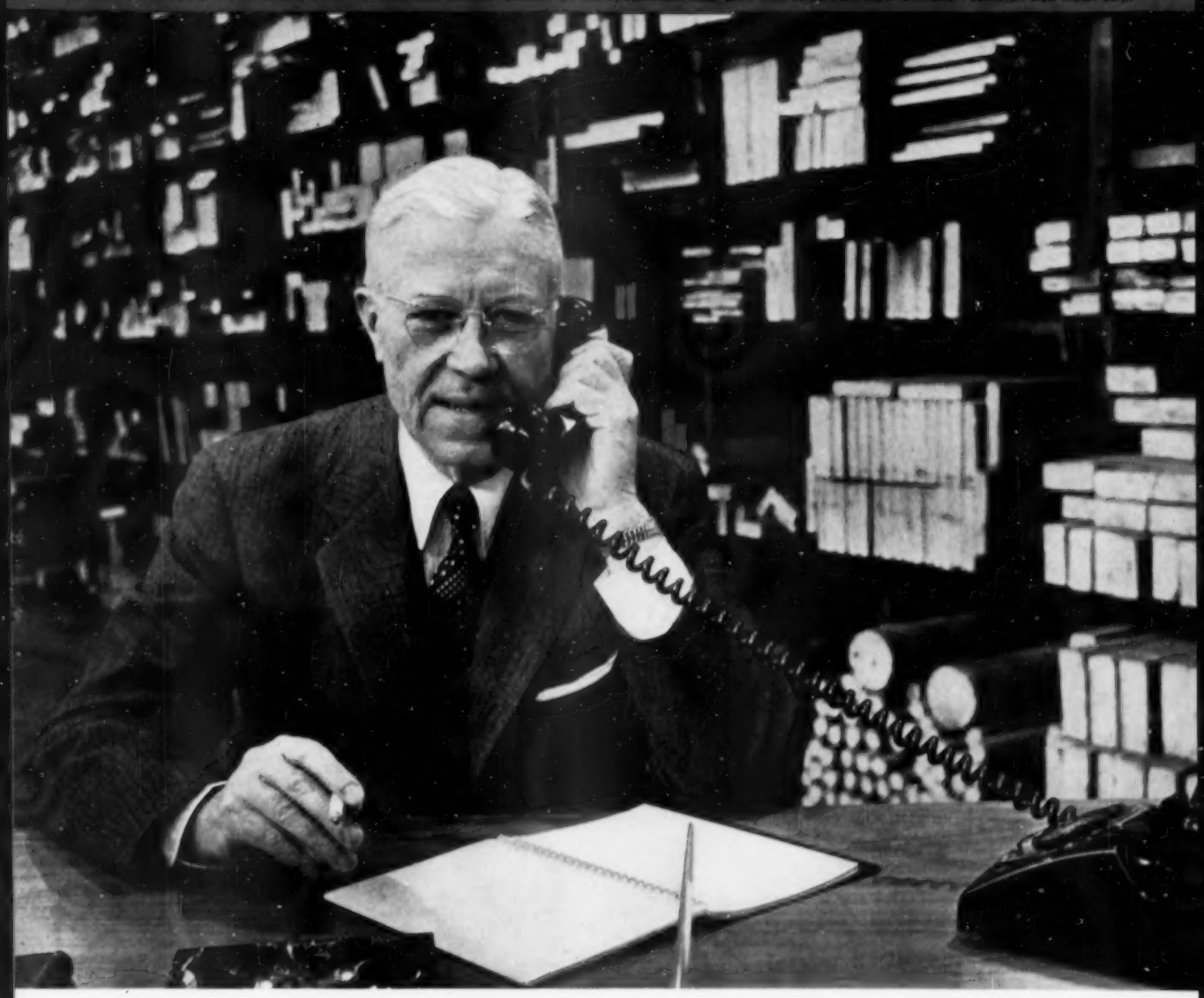
ENGINEERED FOR PRODUCTION

FOOTBURT

PIONEERS IN SURFACE BROACHING

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corp.



For Answers to Tool Steel Problems

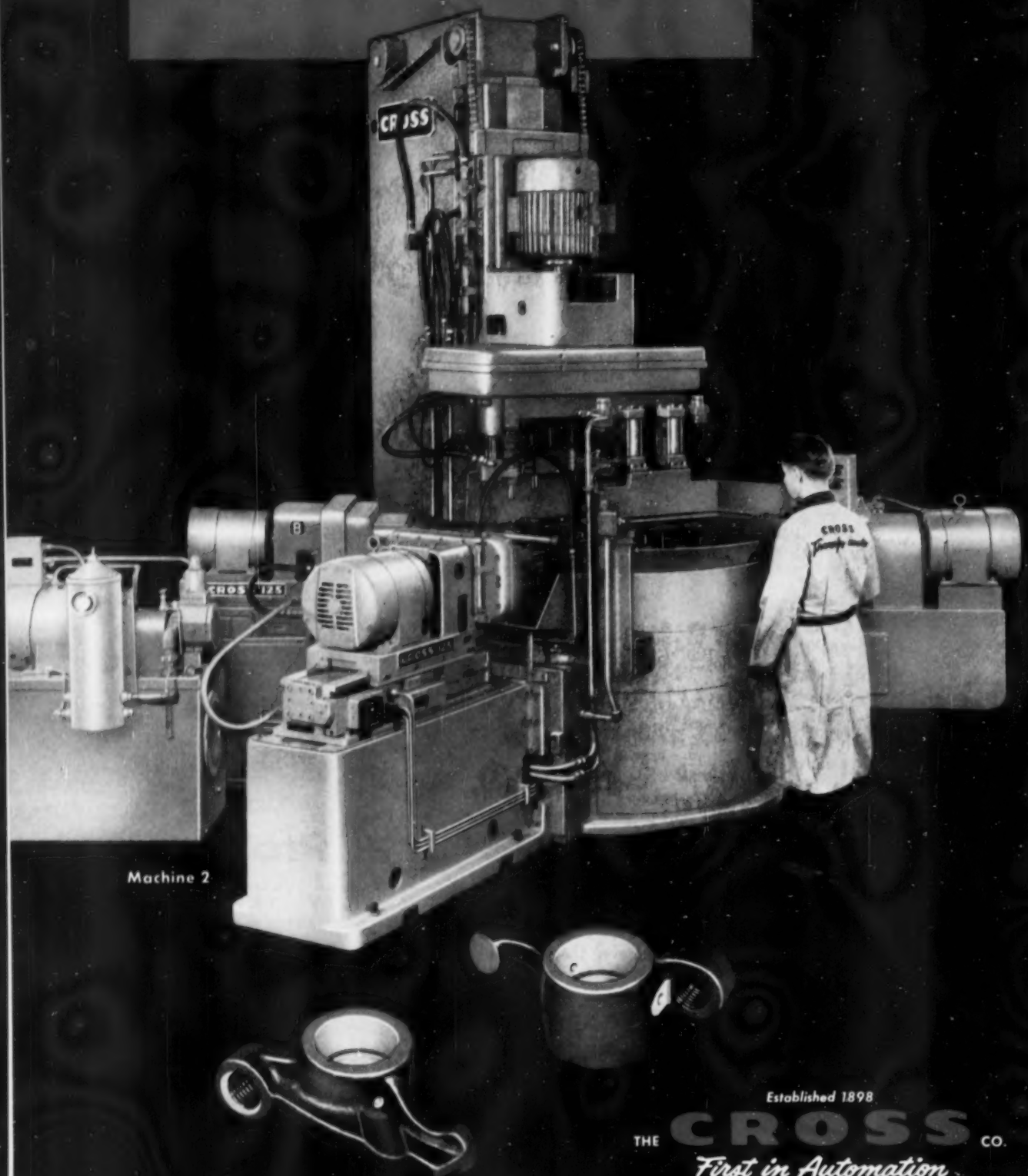
CHECK WITH YOUR BETHLEHEM DISTRIBUTOR

Virtually every business day you are faced with a question or two about tool steel. On occasion the solution is relatively easy, such as ironing out some detail about delivery. But often it can be considerably more complex—perhaps weighing the merits of two similar grades, or determining the proper cycle of heat-treatment to obtain a more effective die life.

Whatever the problem, it calls for expert opinion, and that's where your Bethlehem tool steel distributor comes in. For he's a specialist in tool steel matters, and it's part of his job to see that your questions are answered promptly and courteously. Besides, he can also save you time when you need tool steel, for his diversified stocks are ready to go at a moment's notice. Make it a point to check with your Bethlehem distributor often. It will take but a few minutes at most, and it's one of the wisest moves you can make.

BETHLEHEM STEEL

Two Dial Type Machines Process Valve Rocker Arms



Machine 2

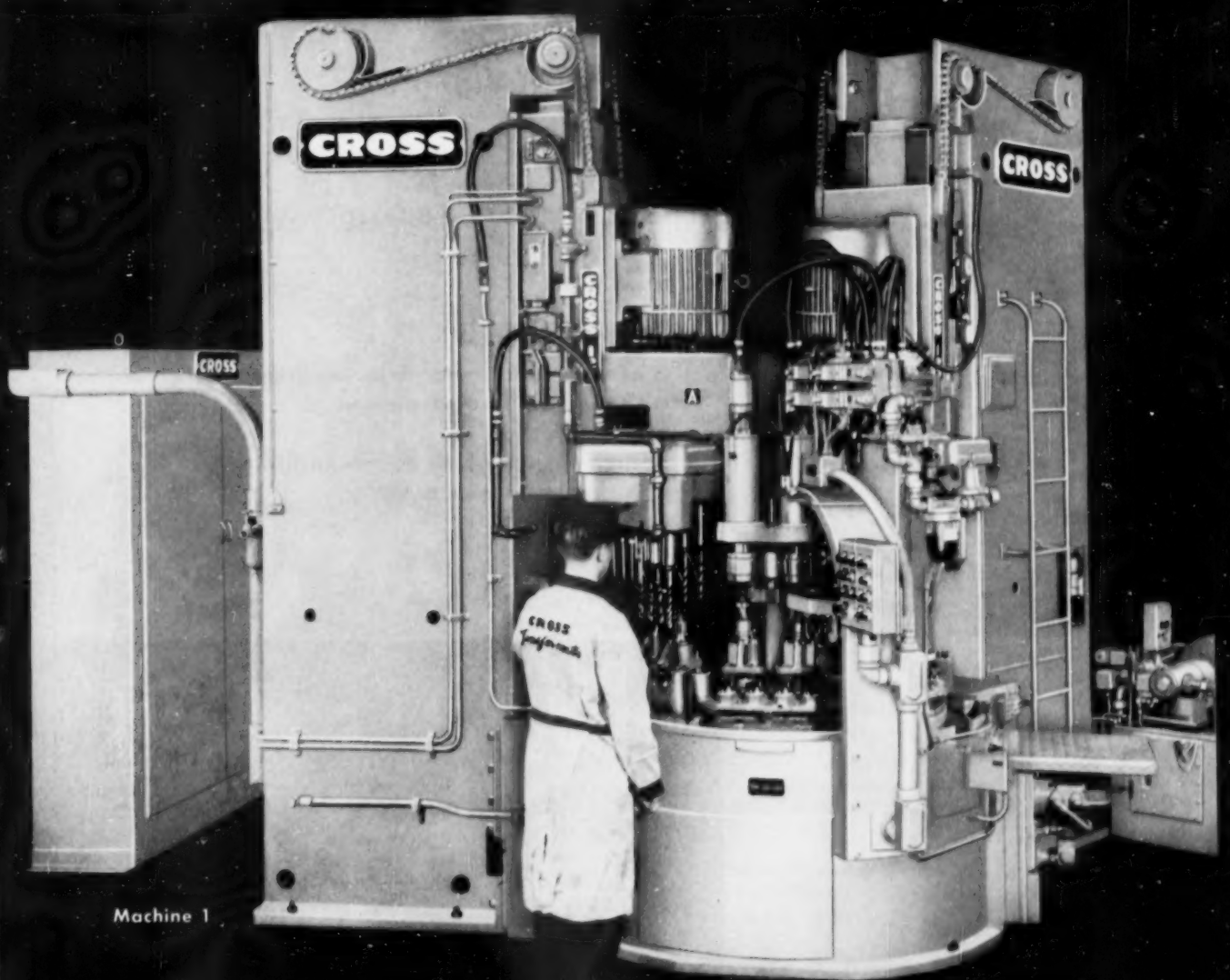
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

More Specials by Cross



Machine 1

★ 800 pieces per hour at 100% efficiency.

★ Four parts machined in each station.

★ Machine 1 drills and reams rocker shaft hole; forms oil groove; drills one oil hole. Machine 2 drills, chamfers and taps adjusting screw hole; drills, counterdrills and spotfaces second oil hole.

★ Push button controlled power wrenches operate fixture clamps.

★ Cross "building block" construction provides flexibility for part design changes.

★ Complete interchangeability of all standard and special parts for easy maintenance.

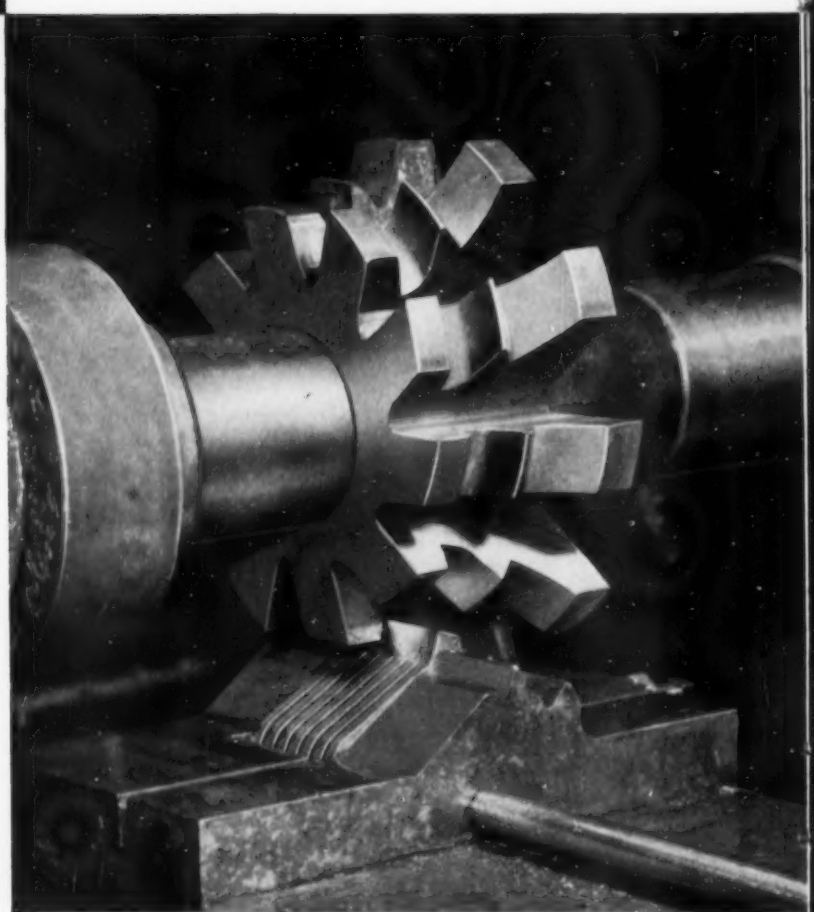
★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for drilling and reaming; individual lead screw feed for tapping; automatic lubrication; pre-set tooling throughout.

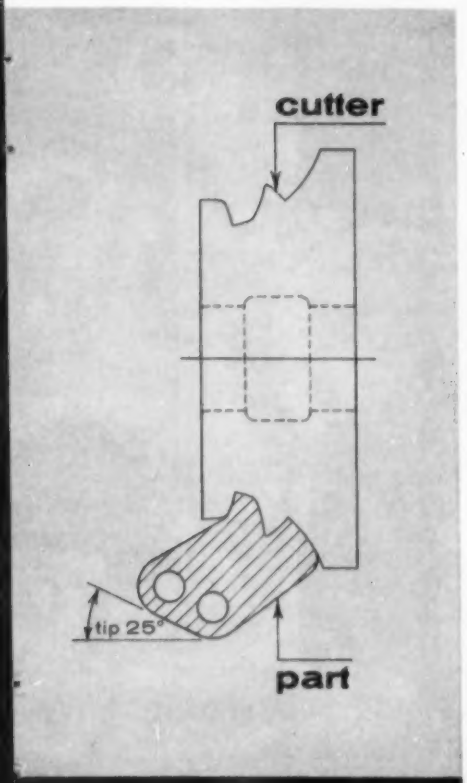
top cutter design
saves 50% in cutter cost,
reduces cutter breakage

BARBER-COLMAN
recommends:

a single solid form relieved cutter to replace two former cutters

improved design to increase tool life and reduce cutter breakage





This Barber-Colman unground form-relieved milling cutter takes the place of two milling cutters formerly operated as a gang for milling these lever sectors. The proportions of the cutter were improved by reducing the cutter diameter and increasing the bore diameter. These improved proportions provide greater rigidity in the cutter and in the milling operation. As a result, initial cutter cost has been reduced 50%, and cutter cost-per-piece further reduced through extended tool life and reduced breakage.

The form on the workpiece is located with respect to the cutter axis to allow sufficient clearance behind all cutting edges. In this particular application, the workpiece is positioned at 25° relative to the cutter axis, permitting the manufacture of a one-piece cutter with adequate cutting clearance.

The material in the part is soft steel of maximum machineability. For best cutting efficiency, the cutter was designed with adequate clearance for milling this material. Cutters are 5″ diameter with 1¼″ bore as compared with previous cutters of 6″ diameter and 1″ bore.

Replacement with a single form relieved cutter has simplified cutter resharpening and reduced cost-per-piece. All Barber-Colman form relieved cutters are index sharpened across the face of the teeth. Cutters are simply and easily resharpened on conventional equipment or Barber-Colman automatic hob and cutter sharpening machines.

With Barber-Colman improved cutter design, pieces are milled at the rate of 3½″ per minute feed, and 150 R.P.M. cutter speed. Tool life averages 3,000 pieces per sharpening.

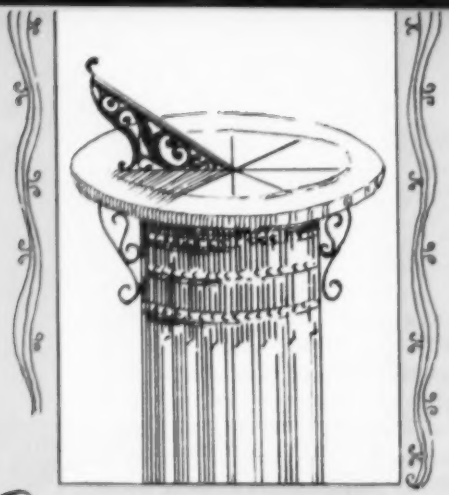
If you are seeking ways to improve your milling cutter efficiency, consult Barber-Colman cutter engineers. Their skill and experience in applying advance cutter design features will help to solve your milling problems.

BARBER-COLMAN COMPANY

888 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN



Great in its day...

BUT
WOULDN'T YOU RATHER HAVE THE
LATEST TECHNICAL ADVANCE?

Heller "Job Tempered" Flat Ground Die Steel

cuts tool making costs 4 ways:

A great new addition to Heller's famous tool line — "Job Tempered" Flat Ground Die Steel — offers solid, cost-cutting advantages to users in four specific ways:

1. **Over 1300 standard stock sizes available** provide the right size for the job — minimum waste in cutting to size — maximum utilization of each piece.

2. **Requires no pre-finishing.** Tool patterns may be laid out directly on its super-smooth 25-35 micro-inch surface.

3. **Easy to machine.** Spheroidize annealed structure of this high grade alloy steel saves time in making the actual tool.

4. **Easy to heat-treat.** Wide hardening ranges make heat treating non-critical. Simple instructions on every package show how to "Job Temper" the tool to get maximum service life and performance on the job.

You get extra assurance that "Job Tempered" Die Steel is *right* because the analysis has been checked and recommended by leading consulting metallurgists. All these advantages add up to real cost-savings in making tools . . . and maximum tool performance under the toughest service conditions.

wide range of standard and stock sizes available in oil hardening and air hardening types

	Oil Hardening	*Air Hardening*
Lengths	18" and 36"	36"
Thicknesses	1/64" to 1 3/8"	1/8" to 2"
Widths	1/2" to 14" depending on length and thickness	1" to 10"

Stock squares also available.

useful, convenient protective packaging

All sizes are individually packaged, fully protected from rusting and scratching. Analysis, heat treating instructions and dimensions are clearly indicated on every package.

GET THIS HANDY SELECTION CHART!

Shows at a glance the complete range of standard and stock sizes and stock squares of Heller "Job Tempered" Die Steel available from your Heller Distributor.

HANG IT ON YOUR WALL FOR QUICK, EASY REFERENCE.

HELLER TOOL CO. SINCE 1858

Heller nucut

HELLER TOOL CO.
Newcomerstown, Ohio

America's Oldest File Manufacturer
A subsidiary of Simonds Saw and Steel Co.

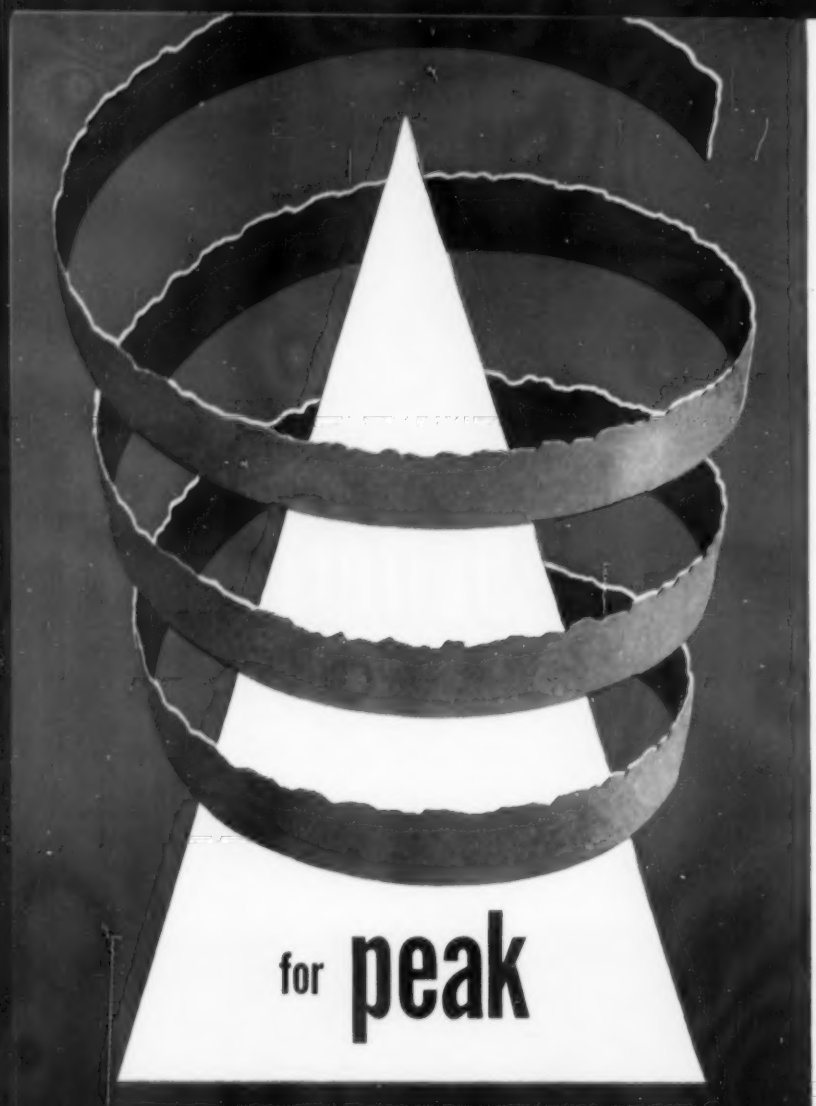
the analysis recommended by leading consulting metallurgists

SOLD EXCLUSIVELY THROUGH

Heller Distributors

"YOUR OUTSIDE TOOL ROOM"

Heller "Job Tempered" Tools



for **peak**

high speed steel performance

specify

VASCO

Supreme

TYPICAL REASONS-WHY . . .

turning

On B-1113 stock, cast alloy gave 500 pieces per grind. *Vasco Supreme* delivers 3500-4000 pieces—upping production 20%.

milling

Cast iron cams. Standard high speed steel formerly used gave 7 cams per grind—*Vasco Supreme* now cuts 135!

drilling

Glass fiber. Standard high speed steel on this material, 4-5 holes. *Vasco Supreme*, 1400 holes before sharpening.

form cutting

SAE 4340. Using 18-4-1 nitrided, customer got 380-400 pieces per grind. *Vasco Supreme* changed matters: 906-1230 pieces.

nibbling

Steel plate. Large-diameter rings, 3/16" thick, are nibbled by tool and die cutting inside and outside of circle. *Vasco Supreme* gives twice the production per grind over competitive grade.

compacting

Electrolytic iron powder. *Vasco Supreme* compacting punch produced 4,000,000 parts (gears) during run.

blanking

High silicon sheet. On indexing type lamination die, previous high-carbon, high-chrome steel made 3000 hits . . . *Vasco Supreme* ran 65,000.

scalping

Hard drawn brass and copper. Dies of *Vasco Supreme* provide 300 per cent longer life than 18-4-1 steel.

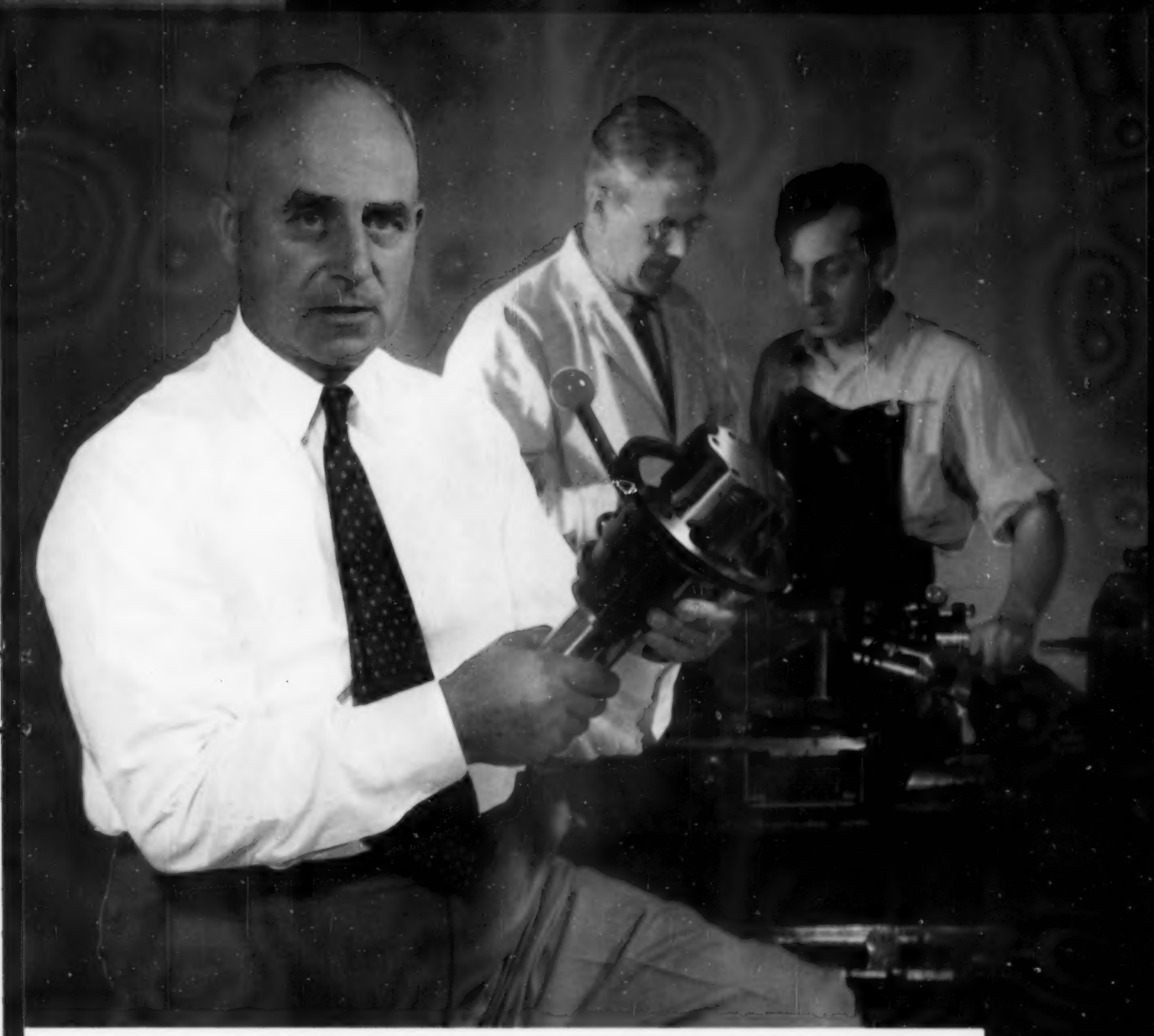
and for your own particular application

Give first thought to Vasco Supreme. Have a metallurgically-trained Vanadium-Alloys sales engineer check with you on the benefits you can expect, and let Supreme deliver!

VANADIUM-ALLOYS STEEL CO.

LATROBE, PENNSYLVANIA

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • **EUROPEAN ASSOCIATES:** Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)



John Topman, Factory Superintendent, says:

"I LIKE GEOMETRICS because . . .

. . . I'm interested in production schedules, costs and quality control. GEOMETRIC tools suit me on all counts, they're dependable, economical and, of course, you can't beat them for accuracy. Just look at the workmanship in this collapsing tap!

Their distributors and their own service engineers give us wonderful co-operation, too. Yes, I'm sold on GEOMETRIC Die Heads and Collapsing Taps."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

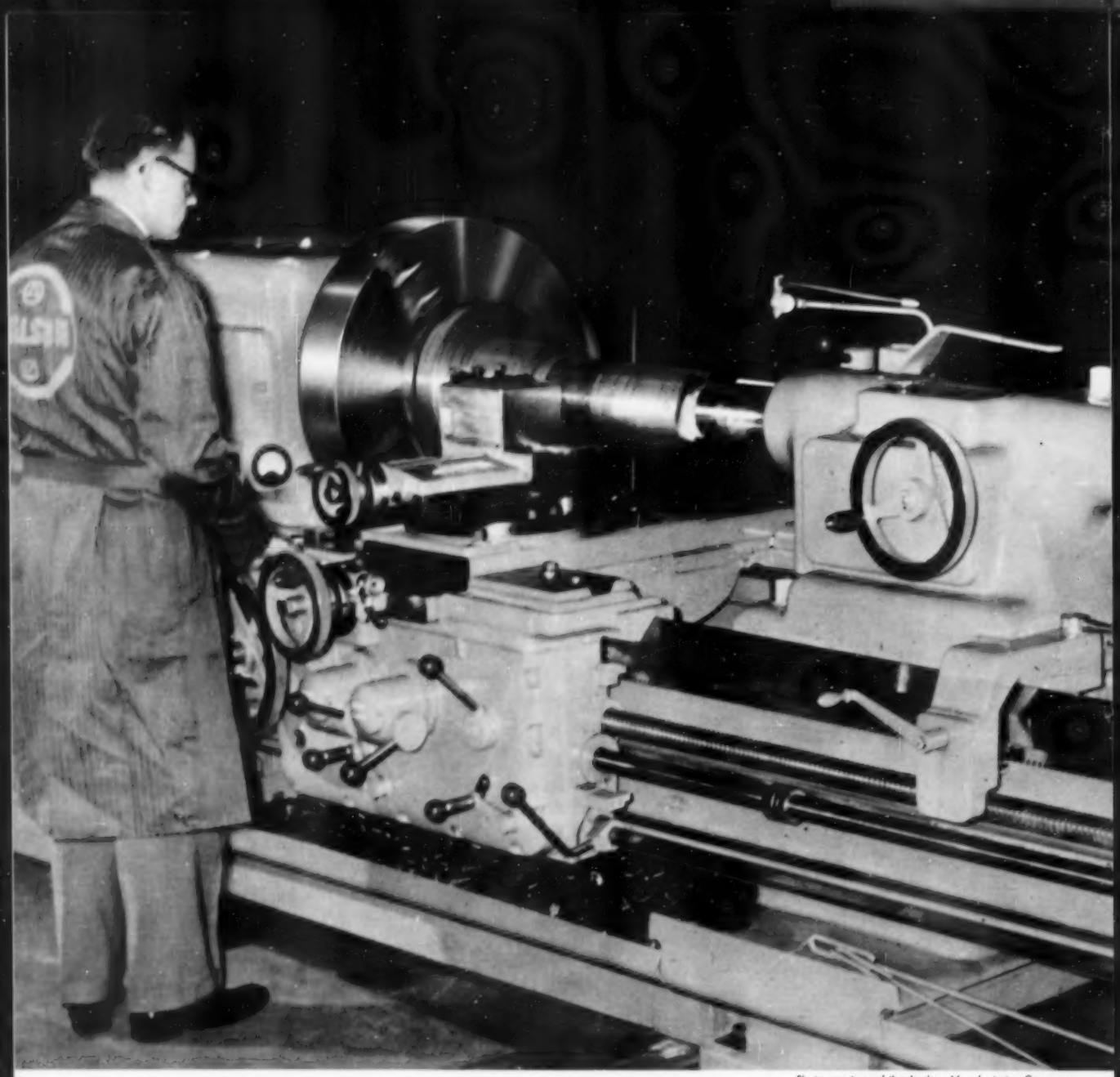


Photo courtesy of the Axelson Manufacturing Company

THE LATHE — *Axelson 4025 Heavy Duty Engine Lathe*

THE OPERATION — *Taking 3/4" cut on 1045 forged steel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!

NOTICE

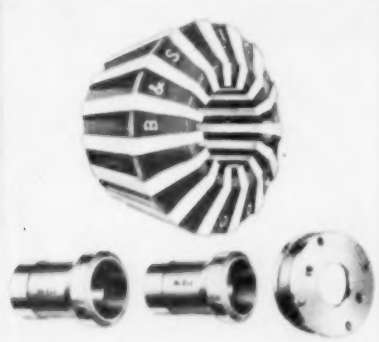
to all users of Brown & Sharpe Screw Machines with 3/4" spindle capacity

Because of exceptional results obtained with Rubber-Flex* Collets, we recommend that you USE RUBBER-FLEX COLLETS FOR HOLDING ROUND STOCK ON THE FOLLOWING MACHINES:

A All B&S Automatic Screw Machines of 3/4" spindle capacity with Serial No. 2015 or higher. (Since 1914.)

B All B&S Hand Screw Machines of 3/4" spindle capacity with Serial No. 540-0-1 or higher. (Since 1951.)

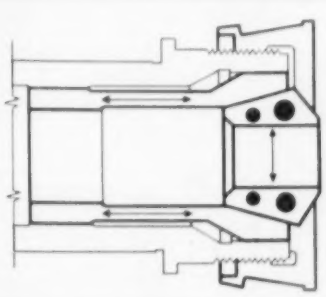
(NOTE: Rubber-Flex Collets are furnished as standard equipment with new No. 2 Automatics of 3/4" capacity.)



NEW, DIFFERENT DESIGN

The Brown & Sharpe Rubber-Flex Collet is a permanent assembly, composed of hardened and ground steel jaws, separated and supported by special, oil-resistant synthetic rubber. It is used with a chuck nut and a chuck sleeve. When the sleeve is moved forward, it closes the jaws of the collet *parallel* on the work.

Extensive tests and customer production experience have shown that modern Rubber-Flex Collets cost less to use and perform better than any other collets available for use on the above machines. Here are the advantages you can expect from them:



CUT COLLET INVENTORY WAY DOWN

Each Rubber-Flex Collet has a wide nominal range of .050". A set of only thirteen collets, two sleeves and a chuck nut handle *any* size of round stock within the capacity of the machines . . . from .095" to 3/4" . . . and no "special" collets are needed.

GRIP TIGHT AND CONCENTRICALLY

The parallel action of the long Rubber-Flex jaws gives them the strongest, most accurate grip of any collet made. The grip actually increases as the power of the cut is increased, through a wedging action of the jaws.

LAST UP TO 6 TIMES LONGER THAN OTHER COLLETS

The jaws of this collet are long and can be held to maximum hardness, since spring temper is not required. They wear slowly and evenly because they bear parallel on the work.

WILL NOT "STICK"

The Rubber-Flex Collet opens fast and cleanly every time. No production time is lost due to a sticking collet.

SEAL OUT CHIPS AND COOLANT

This collet has no slots which will admit chip-laden coolant to vital spindle areas of the machines. It forms an hermetic rubber seal automatically against the chuck nut and around the work.

PLAN NOW FOR GRADUAL REPLACEMENT

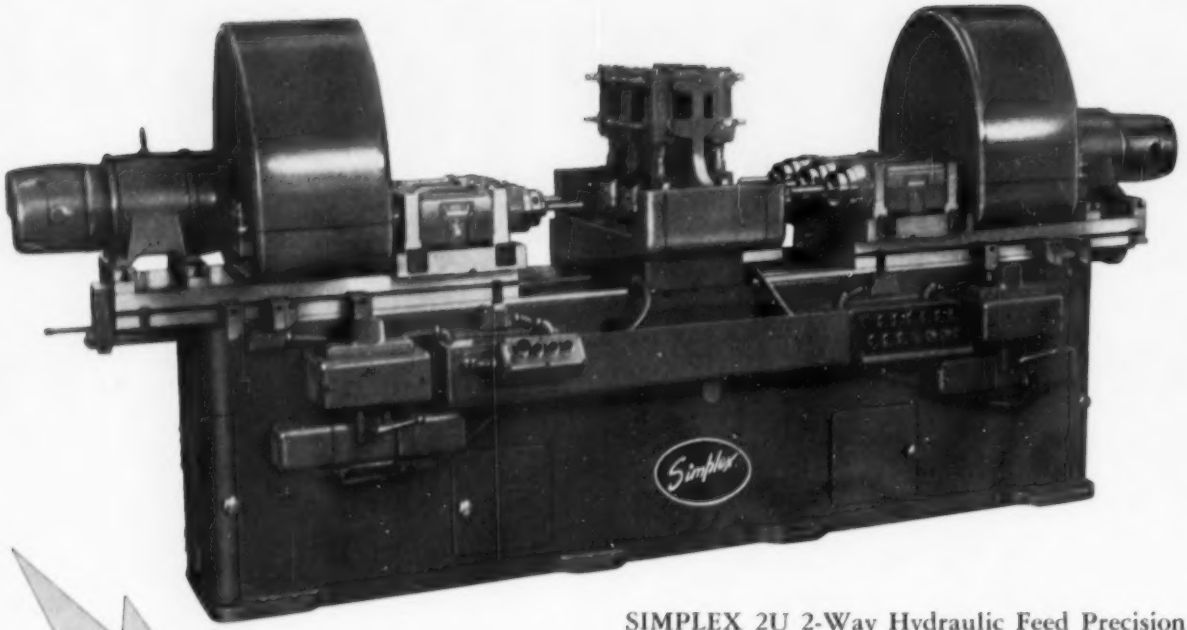
As your present collets for round stock wear out, we recommend that you change over to Brown & Sharpe Rubber-Flex Collets. Ask your Brown & Sharpe distributor for a demonstration. Brown & Sharpe Mfg. Co., Providence, R. I.

**Trade-mark of the Jacobs Manufacturing Company, which makes these collets for Brown & Sharpe.*

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe B·S

MILLING, GRINDING AND SCREW MACHINES, CUTTERS, MACHINE TOOL ACCESSORIES, PRECISION TOOLS, GEAR, VANE, AND CENTRIFUGAL PUMPS

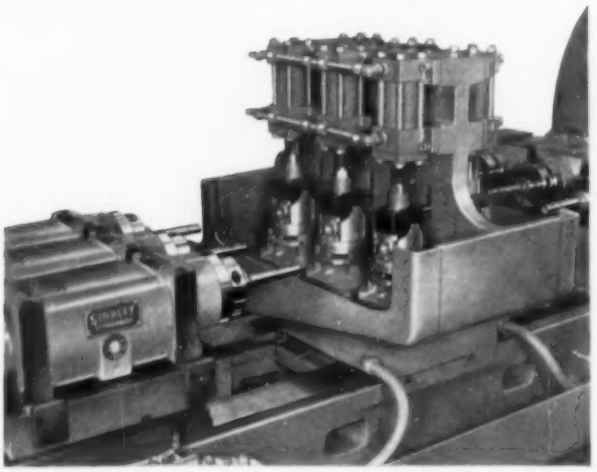


25 YEARS
1932 – 1957

Simplex

PRECISION BORING MACHINES

SIMPLEX 2U 2-Way Hydraulic Feed Precision Boring Machine complete with six #2 SIMPLEX self-contained automatically lubricated precision boring heads and a platen type work-holding fixture designed to hold six pistons for semi-finish and finish boring of the wrist pin holes. The electrical and hydraulic system on this machine is made to conform to J. I. C. Standards.



Hydraulically clamped type work-holding fixture designed to hold six pistons. The piston pin holes are semi-finish and finish bored at the rate of approximately 400 per hour at 100% efficiency.

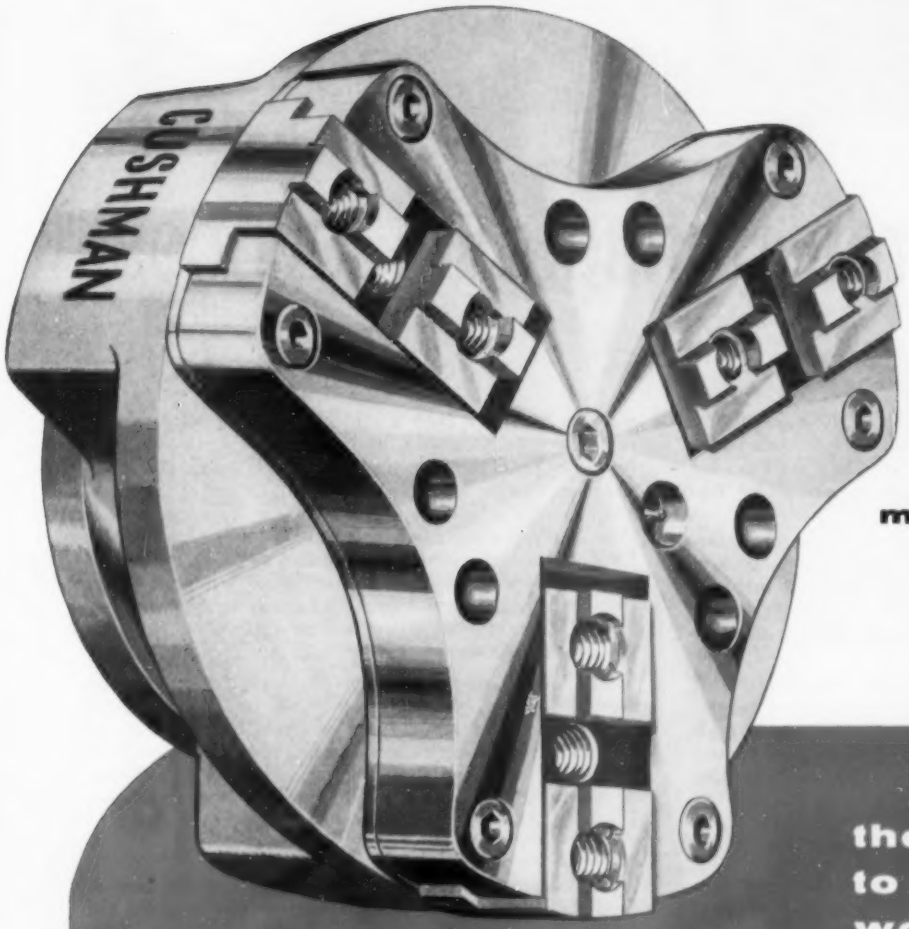
SIMPLEX MACHINE TOOL CORPORATION

4528 WEST MITCHELL STREET

MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

CUSHMAN CHUCKS



high speed aluminum body air operated chucks

matching air cylinders

the answer to precision workholding

CUSHMAN CHUCKS GIVE CHUCK-ABILITY
—The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right workholding devices.

CUSHMAN CHUCKS . . .
a Product of American Quality, Labor and Materials

SOLD THROUGH YOUR INDUSTRIAL DISTRIBUTOR

THE CUSHMAN CHUCK COMPANY

Hartford 2, Connecticut

CUSHMAN the CHUCKMAN CHUCKS AND ACCESSORIES

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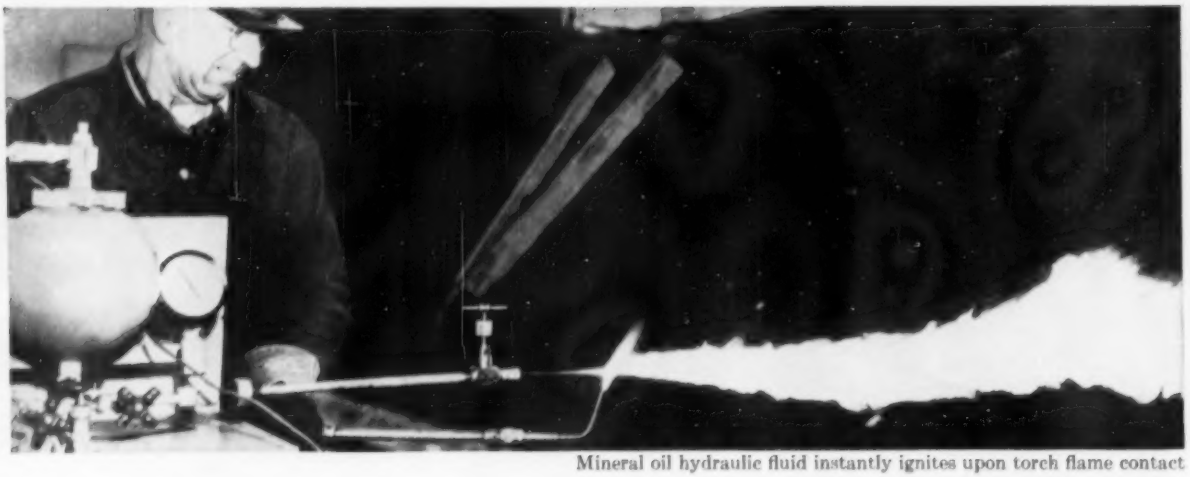


Mineral oil hydraulic fluid instantly ignites upon torch flame contact

Fire resistance plus low cost

FOR MANY YEARS frequent industrial fires involving hydraulic fluids have taken their toll in man-hours and high costs. This has created a widespread need for a relatively inexpensive all-purpose, fire-resistant hydraulic fluid.

In undertaking this challenge, Shell Research Laboratories spent over four years in laboratory and field testing before a solution was reached. The result was the introduction of Irus* Fluid 902 . . . the first low-cost, oil-base fluid that, under plant conditions, actually snuffs out fire.

The new formulation is a specific combination of petroleum oils mixed with water and emulsifying agents. It gains its fire resistance through a relatively high water content. Irus Fluid is perfectly adapted to the majority of hydraulic systems. The following is typical of many reports in Shell files.

Typical Problem and Solution

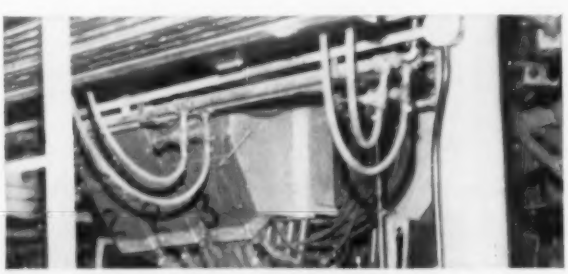
The welding plant of a prominent automotive manufacturer employing 100 hydraulically operated electric welders formerly used a straight mineral oil fluid. On one occasion, damaged fluid lines allowed this mineral oil under high pressure to spray directly onto the welding area. Sparks ignited the fluid . . . caused an immediate flash fire which resulted in 75% machinery damage before it was extinguished. Immediately following this incident, the changeover was made to Shell Irus Fluid 902. Shortly thereafter a line broke and the high-pressure spray once more contacted welding sparks. There was no fire at all . . . and in a matter of minutes the machinery was operating at full efficiency.

The two photos above provide dramatic proof of its flame resistance. In the photo on the left, conventional hydraulic fluid instantly ignites upon contact with an oxy-acetylene torch flame, whereas Shell Irus Fluid 902 (right photo), under the same conditions, does not support combustion beyond an inch or two from the flame. *Under plant conditions, it actually snuffs out fire!*

Two-Way Economy

An advantage not to be overlooked is the low cost of Irus Fluid 902. Many plant operators now making the

A leak is quickly spotted because of Irus Fluid's distinctive yellow color.



The complexity of cable lines necessitates the use of a fire-resistant hydraulic fluid to eliminate fire hazard.

Under the same conditions, Shell Irus Fluid 902 clearly demonstrates its fire resistance

in a new hydraulic fluid

switch to Irus Fluid find that it costs up to one-third less than other fire-resistant fluids—and its performance is comparable in every practical respect. This money-saving advantage is a vital consideration not only in the initial purchase price, but in reducing make-up loss expense.

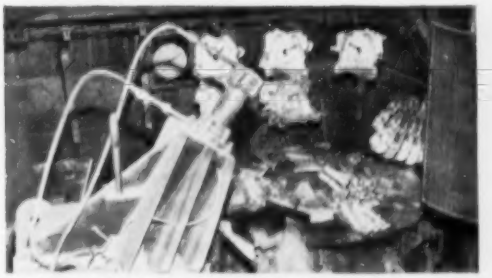
Irus Fluid 902 has other features, too:

1. **It contains no corrosive ingredients and has shown no harmful effects on normal seals, fittings, or bearings . . . it will not promote rust.**
2. **No major equipment modification is necessary . . . simply clean your present fluid thoroughly from the system and replace with Irus Fluid.**
3. **Practical application proves it has exceptional viscosity and lubricating qualities . . . doesn't thin out in use.**
4. **The yellow color of Irus Fluid enables you to spot and trace leaks easily . . . a valuable benefit in preventive maintenance.**

If your operation utilizes die-casting machines, plastic molding machines, glass blowing machines, permanent mold machines or any other hydraulic equipment where fire hazards are of concern, we suggest you investigate the advantages of Shell Irus Fluid 902.

Write or call the Shell Oil Company office nearest you.

®Trademark



Such specialized die-casting machines require a fire-resistant hydraulic fluid to assure maximum safety.

Finger points to line break in hydraulic cable that caused flash fire and machinery damage while operating with mineral oil type fluid.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

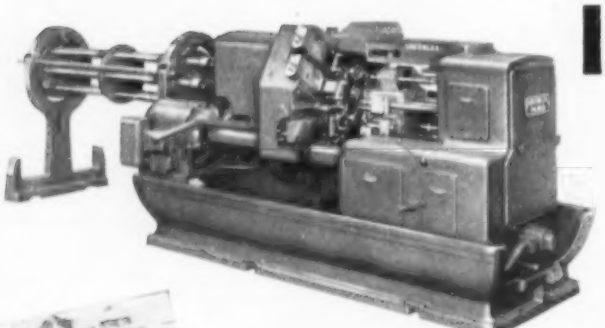
SHELL

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-41

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . production . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.



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4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

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FOR CATALOG
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GREENLEE BROS. & CO.
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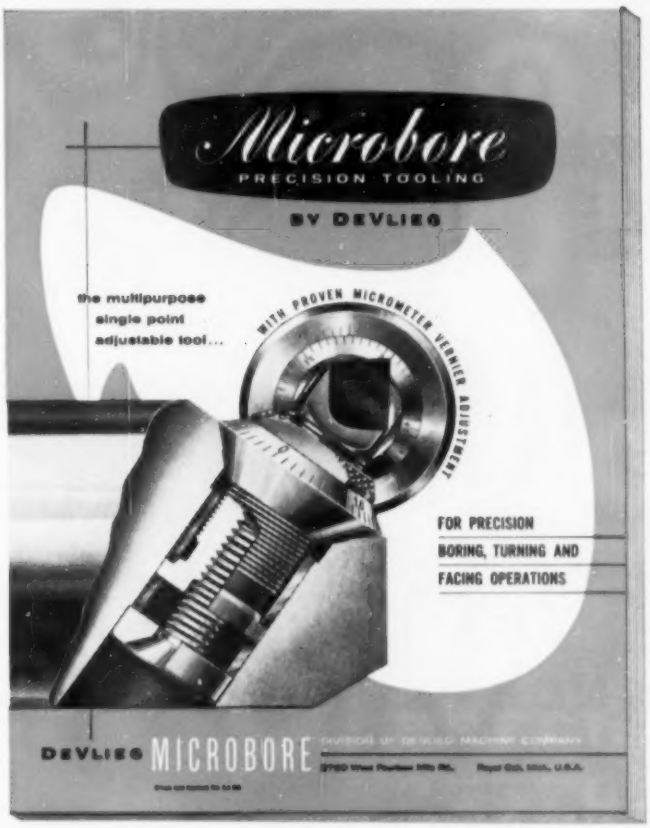
Rockford, Illinois

now a completely new DeVlieg Microbore Catalog

listing 332 standard general purpose boring bars

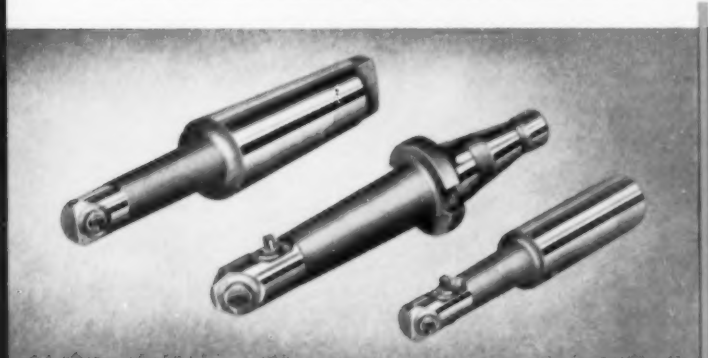


. . . FOR USE ON ALL MAKES AND TYPES OF BORING MACHINES, MILLING MACHINES AND TURRET LATHES!

Yes sir, you'll find it a constant aid. The new descriptive Microbore Catalog No. 58 presents a comprehensive range of newly designed Standard Single Tool and Two Tool Boring Bars, Boring Bar Sets and accessories. It also includes complete application, dimensional and carbide data.

Unique flip charts with simple engineering illustrations make it fast and easy to select the correct Boring Bar with NMTB Taper, Morse Taper or Straight Shank for a specific application.

STANDARD MICROBORE BORING BARS, BORING RINGS AND BORING RING ADAPTERS ARE AVAILABLE SINGLY OR IN SETS



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DeVlieg Microbore

DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

Please send me a copy of your new Microbore Catalog No. 58.

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Company

Title

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ADAMAS "GRADE A"

PERFORMANCE WINNER

For its role as the "standard of the industry" Adamas Grade **A** ranks as performance winner among all competing 6% cobalt straight tungsten carbide grades, (industry classification C-2).

Grade **A**'s outstanding performance in cutting tools, dies, and wear parts has won the applause of carbide users throughout the United States and Canada. Here is a dramatic sample of Adamas Grade **A** throwaway inserts in action on a typical turning operation of Navy "type D" cast iron . . .

192 pieces per corner with a .250 depth of cut, 170 S.F.P.M. and .018 feed.

Even in the carbide industry, stars are made not born. Grade **A**'s success is the result of Adamas' unique manufacturing processes which give Grade **A** its superior combination of three key metallurgical properties: . . . hardness . . . density . . . and transverse rupture strength.

Benefit from Grade **A**'s metallurgical superiority . . . write today for your free copy of: "Grade **A** . . . Metallurgical Facts and Application Tips".

Address Dept. 252

Contact Adamas for the name of your local distributor.

ADAMAS CARBIDE CORPORATION, KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL and CERALOX.

PRECISION PERFORMANCE...

To the archer, precision performance means
a smooth, effortless draw;
a gentle, shock-free release; and riflelike accuracy
in hitting the bull's-eye of the target.

To tap users, precision performance means
production-line continuity, better threaded parts,
increased tap life . . . and BAY STATE!

BAY STATE TAPS

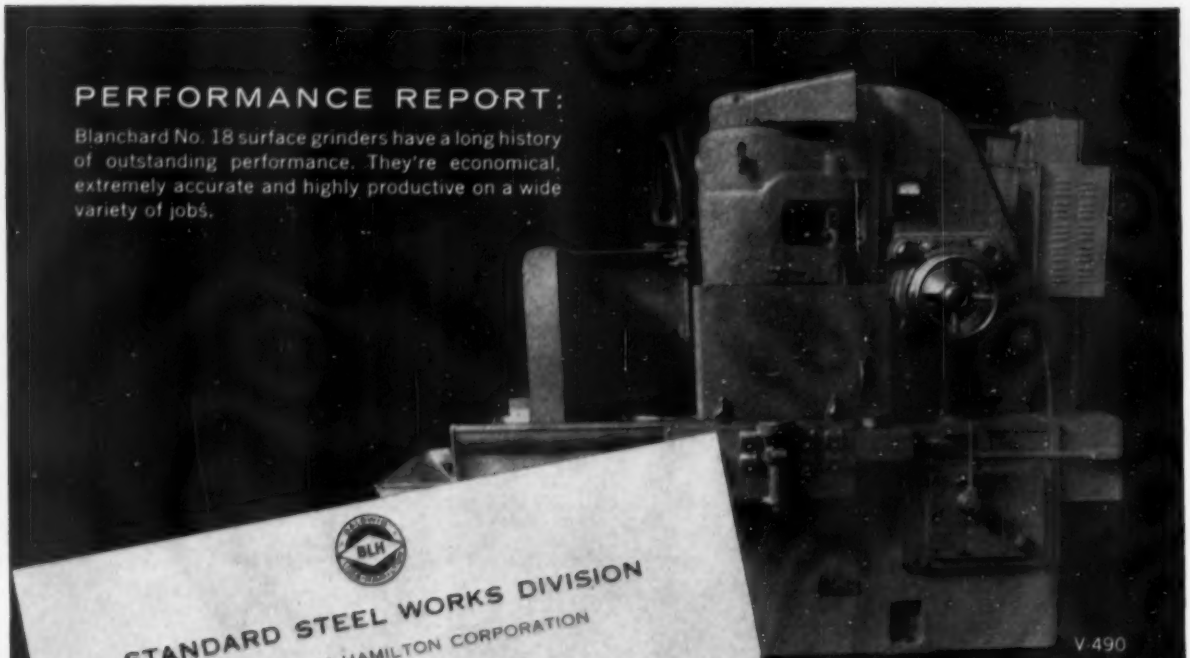
Bay State Tap & Die Company

Mansfield, Massachusetts

On the nearby shelves of your Industrial Supply Distributor

PERFORMANCE REPORT:

Blanchard No. 18 surface grinders have a long history of outstanding performance. They're economical, extremely accurate and highly productive on a wide variety of jobs.



V-490

STANDARD STEEL WORKS DIVISION
BALDWIN-LIMA-HAMILTON CORPORATION
BURNHAM, MIFFLIN COUNTY, PA.

November 26, 1956

Machinery Associates, Inc.
325 N. Lancaster Avenue
Wynnewood, Pa.

Attention: Mr. C. Denson Day, Vice President

OUR PURCHASE ORDER 8781-4576
YOUR ORDER M2-1-809

Gentlemen:

In response to your letter of October 12, 1956 relative to the No. 18 Blanchard High Power Vertical Surface Grinder which you furnished to us on the above order, I wish to advise that this machine has been entirely satisfactory. The machine was purchased primarily for grinding form and hollow bore cutters for our machine shops and the machine was installed in our Small Tool Department. We estimate that the savings which we have already experienced will allow us to amortize the machine in a period of approximately one year. Since the work load on cutters alone kept the machine busy only approximately one-third of the time, we have been able to do additional grinding which was formerly done on other machines and have been able to realize the same economies as we did on the grinding of the cutters.

Yours very truly,

W. A. Whisler, Jr.
Chief Engineer

PUT IT ON THE BLANCHARD

Send today for your free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding", third edition.

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

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Bath Gages open the door to a higher standard of inspection; guarantee absolute controlled measure of threaded and plain parts and holes . . . improve the quality of machined parts and the finished product.

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JOHN BATH & CO., Inc.

28 Mann St., Worcester, Mass.

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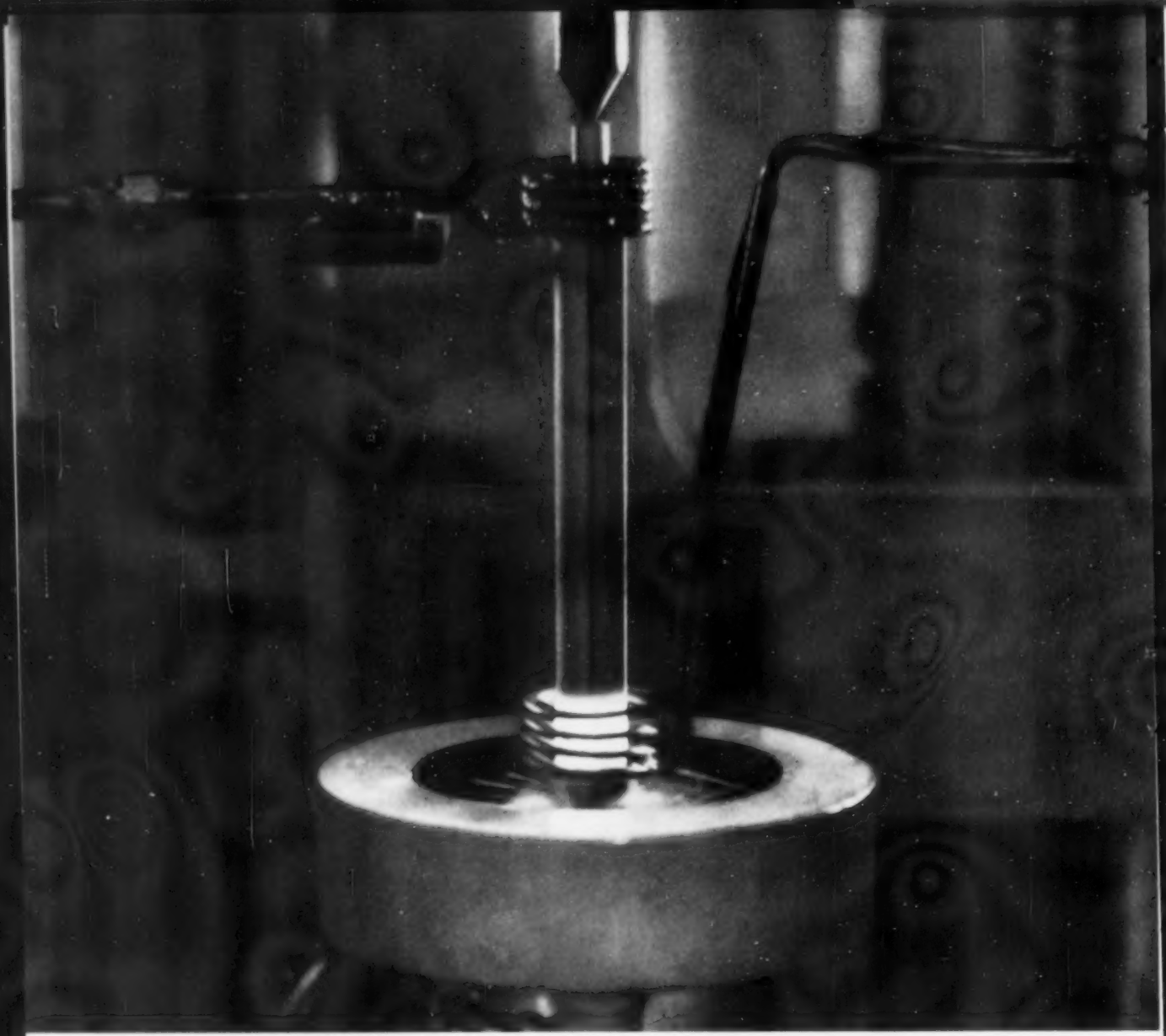


Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining. Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

What every designer should know about

FACE GEARS for Angular Drives

FACE GEARS have distinct advantages which the designer should know. They can be spur or helical, "on-center" or "off-center." The mating members are pinions. Both are generated on Fellows Gear Shapers by cutters having involute teeth.

Utilization of face gears results in a simple, compact design that can be economically manufactured and assembled.

Consider all these advantages:

- quality cutting at low cost
- easier and lower cost assembly
- no appreciable thrust
- pairing for reversal of direction
- tooth bearing not affected by axial displacement of pinion

GET ALL THE FACTS:

Information on the design and cutting of Face Gears is free for the asking. Just write to:

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont

Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE **Fellows** *Gear Production Equipment*

Cuts job time 50%

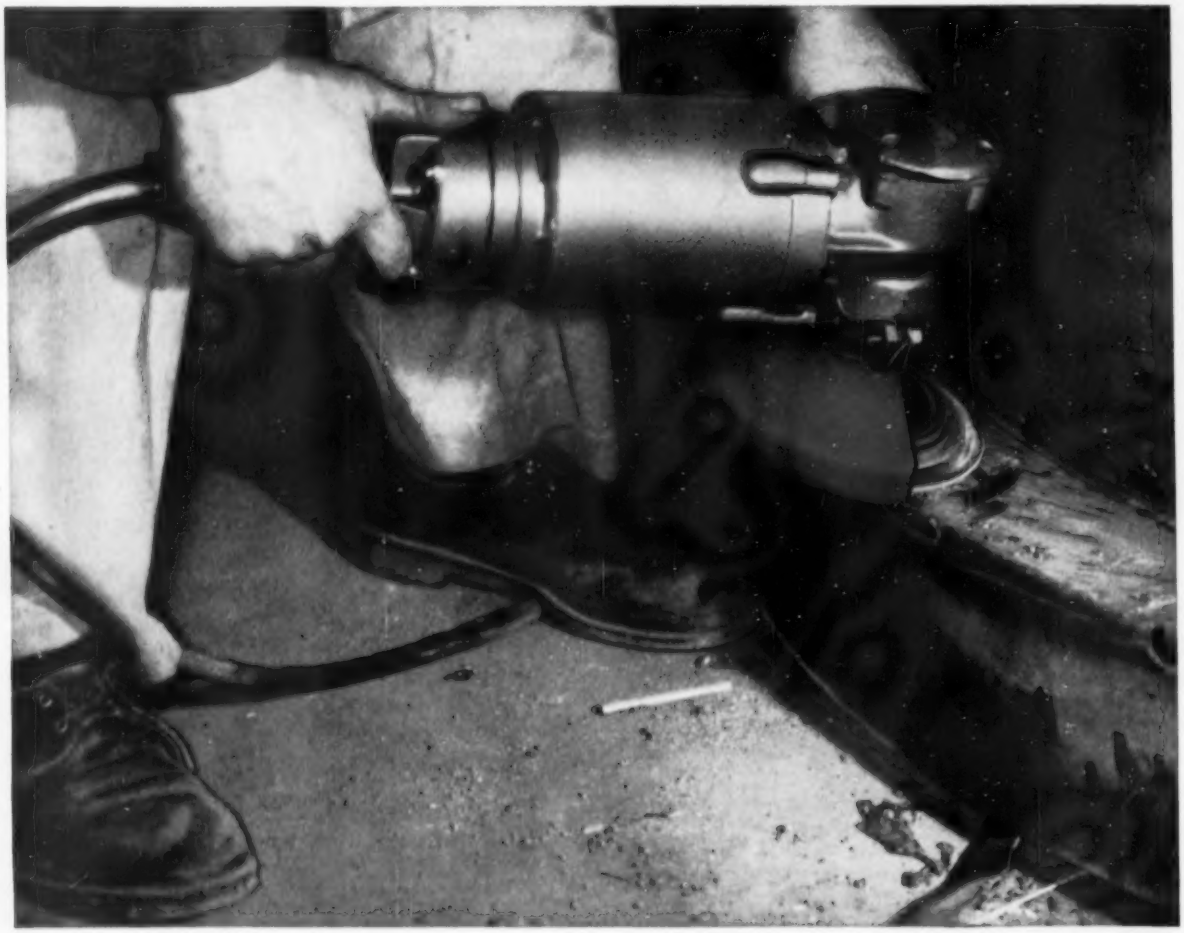
WITH ROTOR

180-CYCLE ELECTRIC GRINDERS

JOB: Grinding weldments of mild steel and stainless steel. With universal electric grinder, took 60 minutes; downtime for maintenance was high. Switched to Rotor 882 VG—180-cycle Right Angle Grinder.

RESULTS: Cuts job time to 30 minutes. Savings pay for new grinders in eleven weeks. Wheels and discs last longer. Downtime for maintenance slashed.

You can be sure of getting the *right tool*...air or high-cycle electric . . . when you call in the Rotor Application Engineer. Write for Bulletin 51 on the Rotor 180-cycle tools or Bulletin 48 on Rotor 360-cycle tools. The ROTOR TOOL Company, Cleveland 32, Ohio.



Here's the RIGHT TOOL for YOUR job!

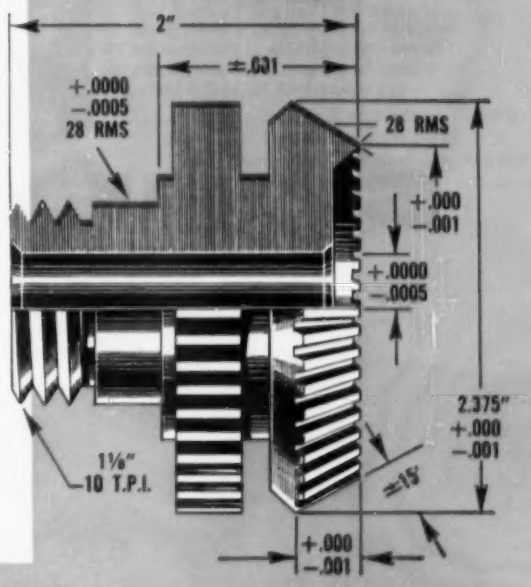
Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS®
CLEVELAND, OHIO

CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* BEVEL CLUSTER GEAR *complete* FROM BAR STOCK *in one operation* READY FOR GEAR CUTTING?

...it can be done on the

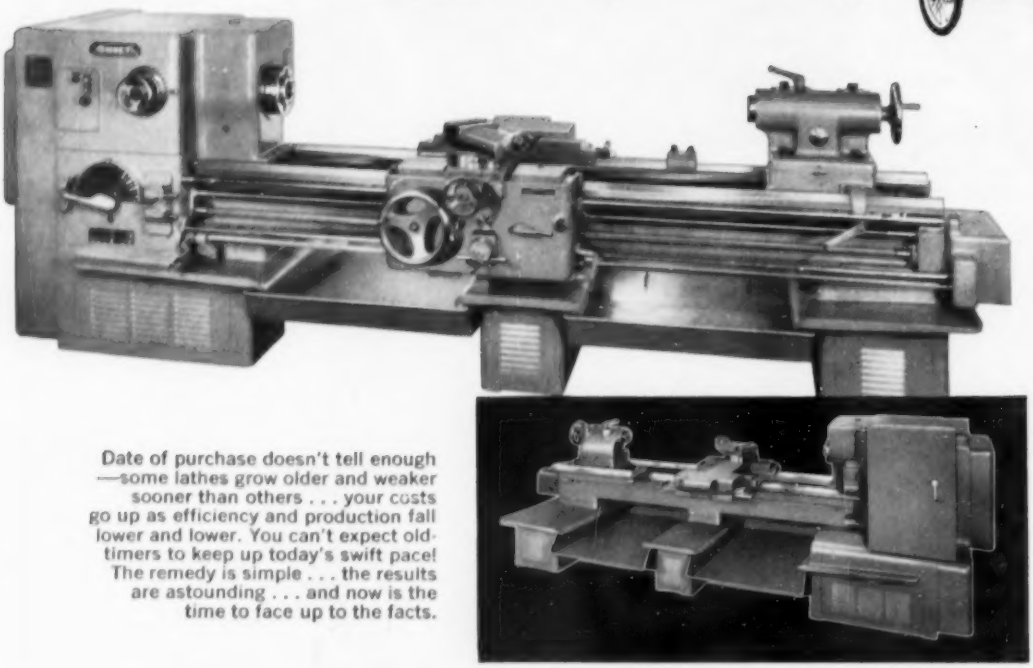
TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Your Present Lathes may be Older than you think!



Date of purchase doesn't tell enough —some lathes grow older and weaker sooner than others . . . your costs go up as efficiency and production fall lower and lower. You can't expect old-timers to keep up today's swift pace! The remedy is simple . . . the results are astounding . . . and now is the time to face up to the facts.

SIDNEY DIAL-MASTER MODEL 32 LATHES

stay young, vigorous and more productive longer.

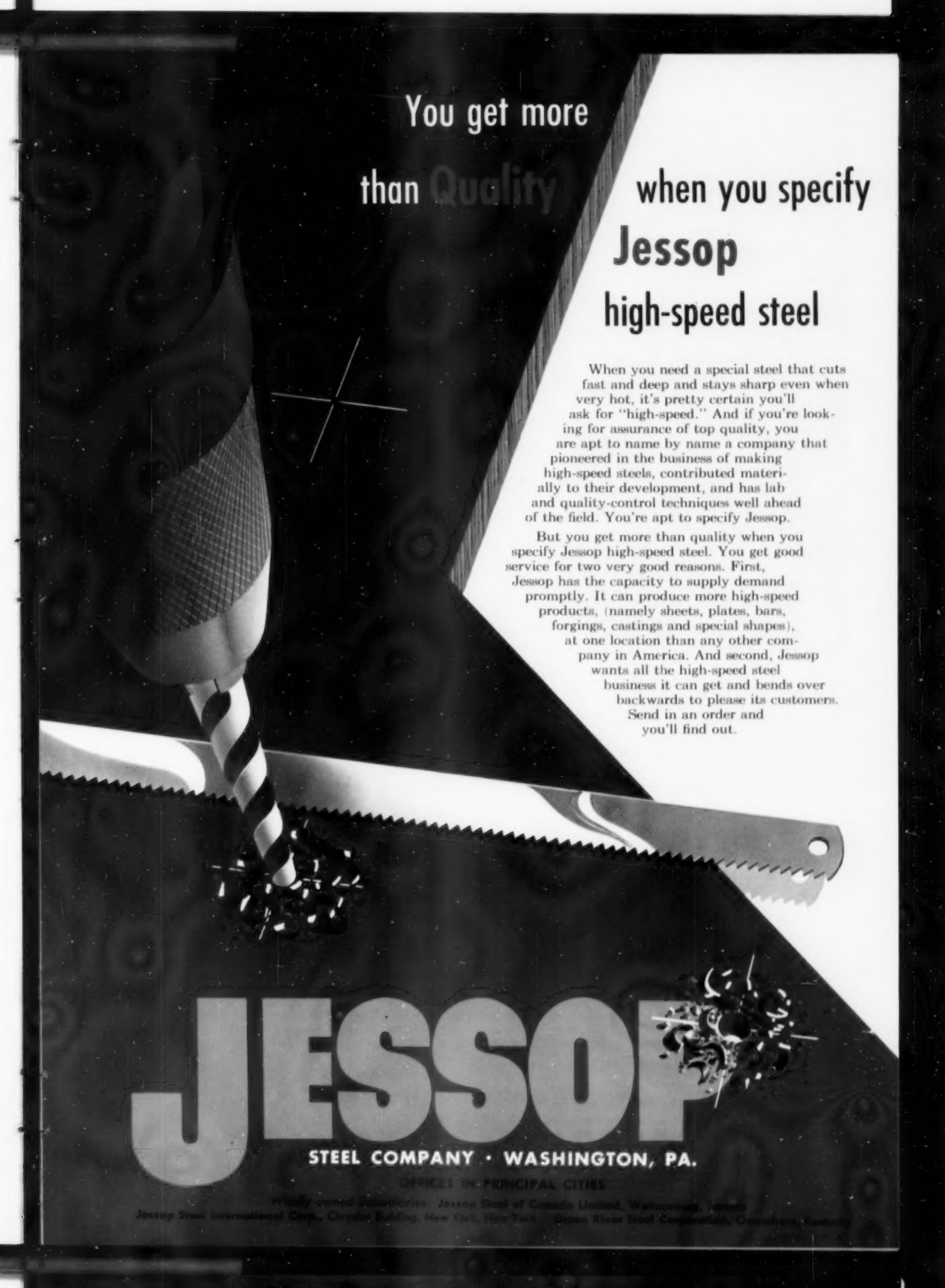
These lathes are designed and constructed to occupy a minimum of floor space so they can be integrated for convenience and efficiency into your plant layout.

Note these Features:

- **HEAD STOCK WITH HERRING-BONE GEARS** provide smooth operation, greater strength and elimination of end thrust thru the double opposed 30° helix angle. Constant flow of power. Filtered automatic forced feed lubrication.
- **32 PRE-SELECTIVE SPINDLE SPEEDS** obtained by rotating dial control. Shift from speed to speed in a lightning-like TWO SECONDS.
- **SINGLE LEVER CONTROL ON CARRIAGE AND APRON** actuates positive serrated jaw plates incorporating all four directions of feed and rapid traverse operating from one control head. All gears (except rack pinion) are enclosed. Automatic lubrication.
- **BED DESIGN UNUSUALLY STRONG AND VIBRATION FREE** with greater bearing area to take downward thrust and greater resistance to deflection and twisting. Superior to conventional two-wall construction.
- **TOTALLY ENCLOSED GEAR BOX** powered from main spindle of headstock. Dial control to change gear without stopping or reducing spindle speed.

Why not take a good, critical look at your present lathes' performance? Write for new Sidney Lathe bulletins or for representative to call.

THE SIDNEY MACHINE TOOL CO.
SIDNEY, OHIO
Builders of Precision Machinery since 1904


You get more
than Quality
when you specify
Jessop
high-speed steel
When you need a special steel that cuts fast and deep and stays sharp even when very hot, it's pretty certain you'll ask for "high-speed." And if you're looking for assurance of top quality, you are apt to name by name a company that pioneered in the business of making high-speed steels, contributed materially to their development, and has lab and quality-control techniques well ahead of the field. You're apt to specify Jessop.
But you get more than quality when you specify Jessop high-speed steel. You get good service for two very good reasons. First, Jessop has the capacity to supply demand promptly. It can produce more high-speed products, (namely sheets, plates, bars, forgings, castings and special shapes), at one location than any other company in America. And second, Jessop wants all the high-speed steel business it can get and bends over backwards to please its customers. Send in an order and you'll find out.
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STEEL COMPANY · WASHINGTON, PA.
OFFICES IN PRINCIPAL CITIES
Wholly owned subsidiaries: Jessop Steel of Canada Limited, Welland, Ontario
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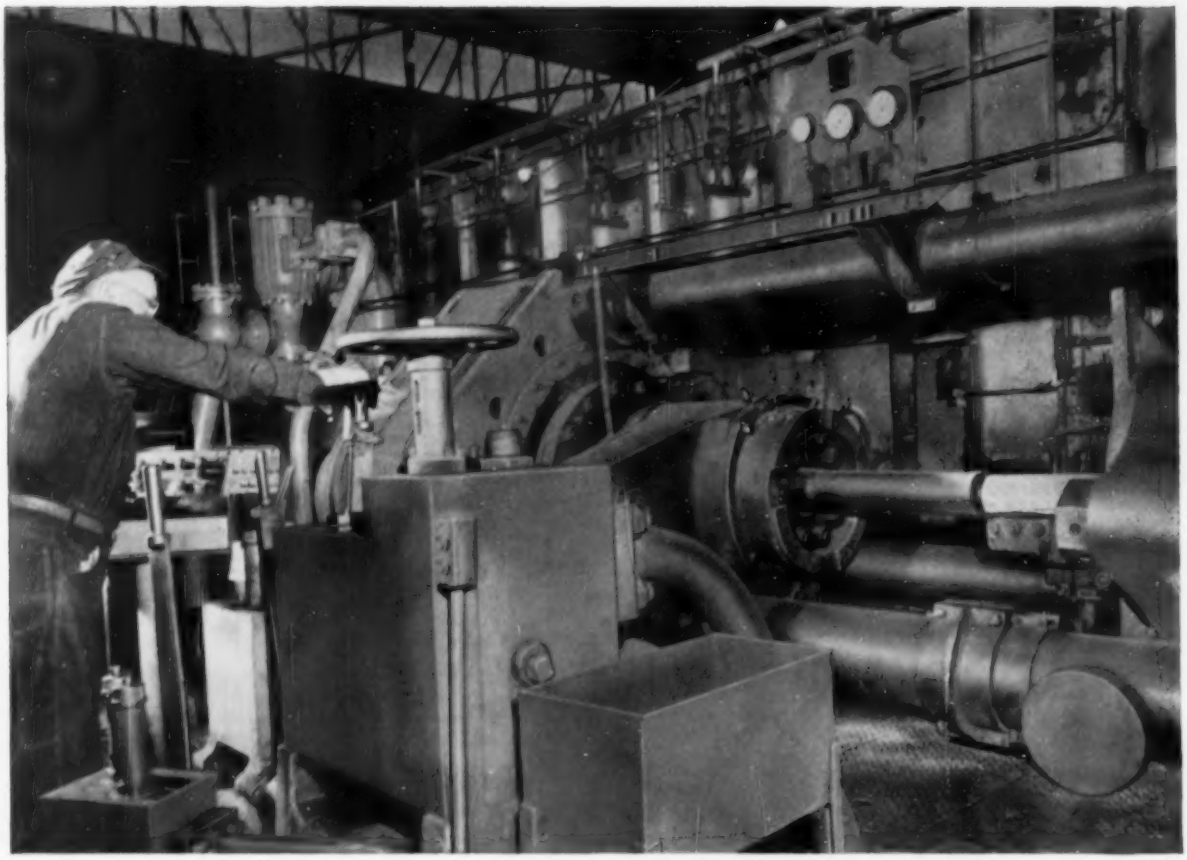
Green River Steel Corporation, Owensboro, Kentucky



2,750-ton Loewy press equipped with Carboloy chrome carbide dies reduces 8″-diameter brass billets to 400 feet of .441″ rod.

Press downtime reduced 80%...

HOT-EXTRUSION BOTTLENECK BROKEN BY CARBOLOY® CHROME CARBIDE DIES

Carboloy cemented chrome carbide is harder than the hardest die steel. It is far more wear resistant and has excellent oxidation resistance, even at temperatures up to 1,800° F. These and other unique physical properties made chrome carbide an ideal die material for solving the production problem, caused by rapid wearing of steel dies used to hot-extrude brass rod, at Mueller Brass Co., Port Huron, Michigan.

Before switching to chrome carbide, unpredictable product size and varying hardness made it necessary to change steel dies frequently. Downtime bottlenecked production rates, and prevented Mueller from getting maximum efficiency from their automated line.

Today, one Carboloy chrome carbide die does the work of 20 steel dies in extruding .441″-diameter free-machining brass rod. Tolerances are constantly held to ±.006″. Production is at a new high, and downtime has been cut 80%.

Carboloy *chrome* carbide may be the economical solution to your hot-extrusion problem. Carboloy *tungsten* carbides may bring similar benefits to your other die operations . . . whether you're cold-extruding, drawing, forming, or blanking. Ask your diemaker about them. Or for more information, and technical assistance, write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Street, Detroit 32, Michigan.*

Progress Is Our Most Important Product

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57-49

Proof of Precision: This 100,000th Spindle

. . . that's right. Ex-Cell-O has produced more than 100,000 precision grinding and boring spindles. They are in use today throughout the world, on a wide variety of important jobs. No other spindle manufacturer has so solid a record for satisfaction—so sound a reputation for building the best.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Improve Milling Methods and Cut Costs with SUNDSTRAND Rigidmils and "*Engineered Production*" Service.

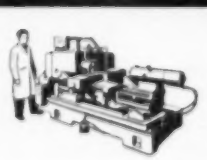
Sundstrand's design, process engineering, and manufacturing skills assure you of obtaining the most practical milling methods.

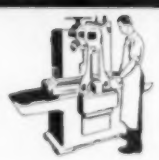
Small Lot Milling

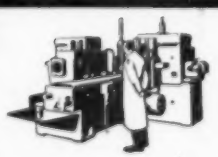
From 4 to 35 pieces per lot yields big savings on this standard Model 55 Rigidmil equipped with Sundstrand universal magnetic fixture. It takes just 12 hours to mill top, bottom and sides of 20 rotary table segments, compared with 22 hours required by former method. Some of the other jobs handled on this machine are shown above.

SUNDSTRAND "*Engineered Production*" Service*

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

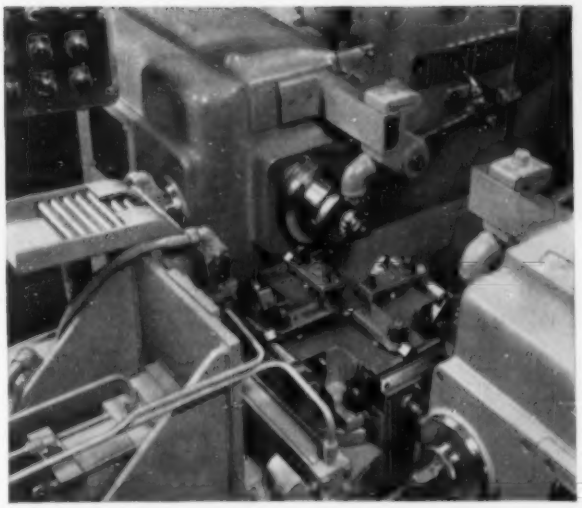


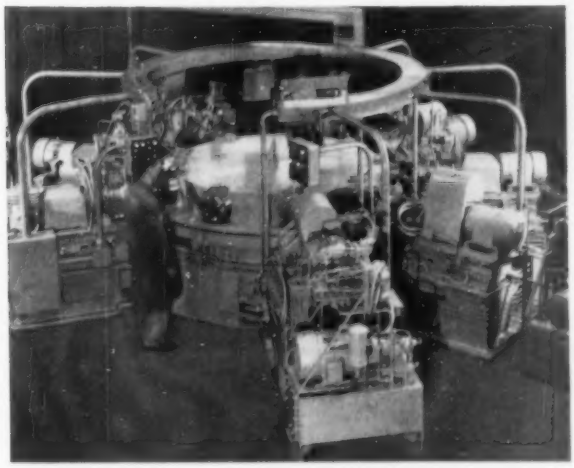




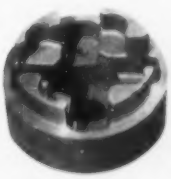
High-Production Milling...

Serrations on both ends of brake pedal shafts are milled automatically at the rate of 200 pieces per hour on this Duplex-type Sundstrand Rigidmil. Automatic 4-position index base and power-operated fixture increase efficiency and reduce burden on operator. All he needs to do is keep hopper loaded with rough parts.





Special Milling...



of 8 pockets with various depths and diameters is performed automatically in transmission rear brake drums on this Sundstrand 9-station special Rigidmil. Only operator requirement is to load and unload parts at the idle station. Work is carried to successive machining stations by automatic index unit. Automatic chip removal unit keeps all work areas clear.

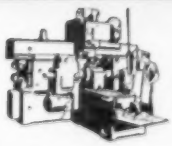
Sundstrand's "Engineered Production" Service offers years of design and production engineering experience coupled with the availability of a wide range of standard milling machines to assure you of getting the most practical milling method.

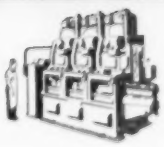
Whether your production requires: (1) a standard Rigidmil, (2) a semi-standard Rigidmil, or (3) a machine designed specially for your job — with Sundstrand you know you'll get the one best answer. Examples shown here illustrate a few jobs with varied production rates being handled with maximum efficiency on Sundstrand Rigidmils.

Sundstrand's "Engineered Production" Service is available to you without obligation. Send a part or part print to Sundstrand's engineering department, or to the field office nearest you to get an "Engineered Production" analysis. You too, will agree that its the sure way to keep costs down, quality high, and production up.

"Engineered Milling Production" data is available in Bulletin No. 782. Write for your copy today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service

FOR BROACHING

It takes all 3

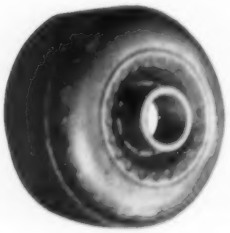
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

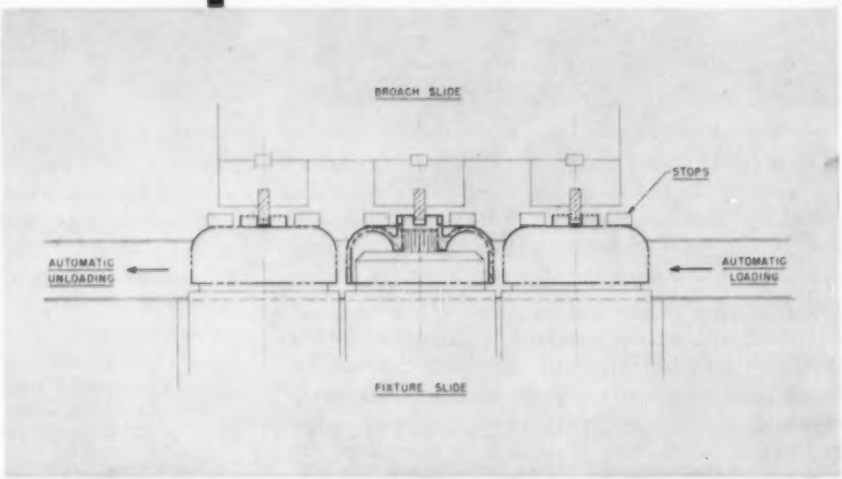
THE JOB—Broaching ¼ inch wide cross slots in torus part with machine arranged for conveyor line operation.

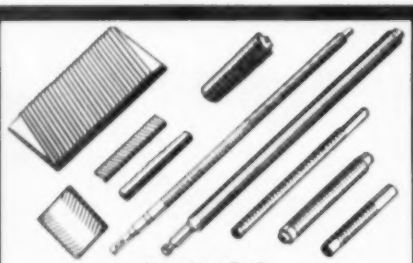
THE RESULT—400 completed parts per hour with two operations performed on each part. Parts are broached three at a time.

1 PROPER BROACH TOOL DESIGN

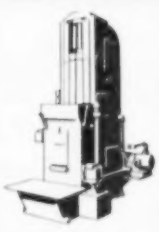
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. Sectional surface broach assemblies used on this job are HSS approximately 50" long. Return of broaching tool to cutting position is timed to coincide with the backward movement of the fixture.



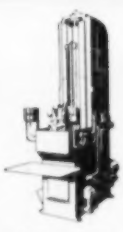




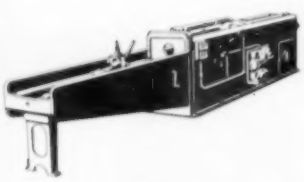
Broaching Tools



Three Way



Single Ram



Horizontal

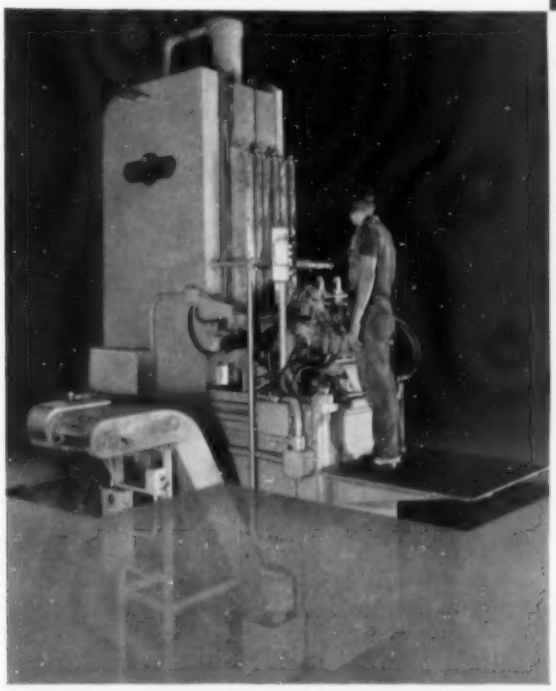
to give you peak broaching performance

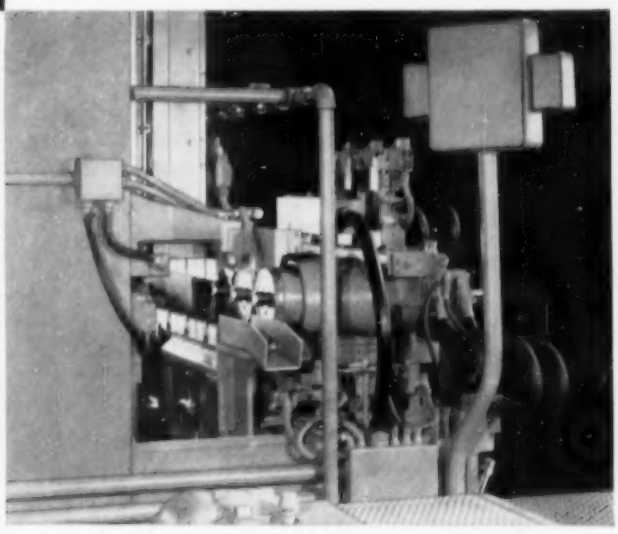
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical hydraulic single-ram surface broaching machine is equipped with an automatic transfer mechanism that carries three parts from the conveyor line into broaching position and ejects them after broaching. Interlock prevents machine operation unless three parts are in the transfer mechanism.

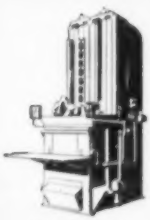
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. The three-station fixture shown in the close-up provides positive clamping of the workpiece for broaching. In addition, it recedes at the end of each broaching pass and indexes 90 degrees for the second pass. On high-volume jobs like these, even with relatively inexperienced operators, production schedules are maintained because the "skills" are built into the tool, machine, and fixtures.

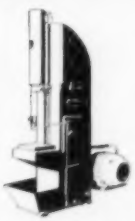




For more information on practical broaching methods, write for Bulletin A717.



Duplex Ram



Presses

SUNDSTRAND

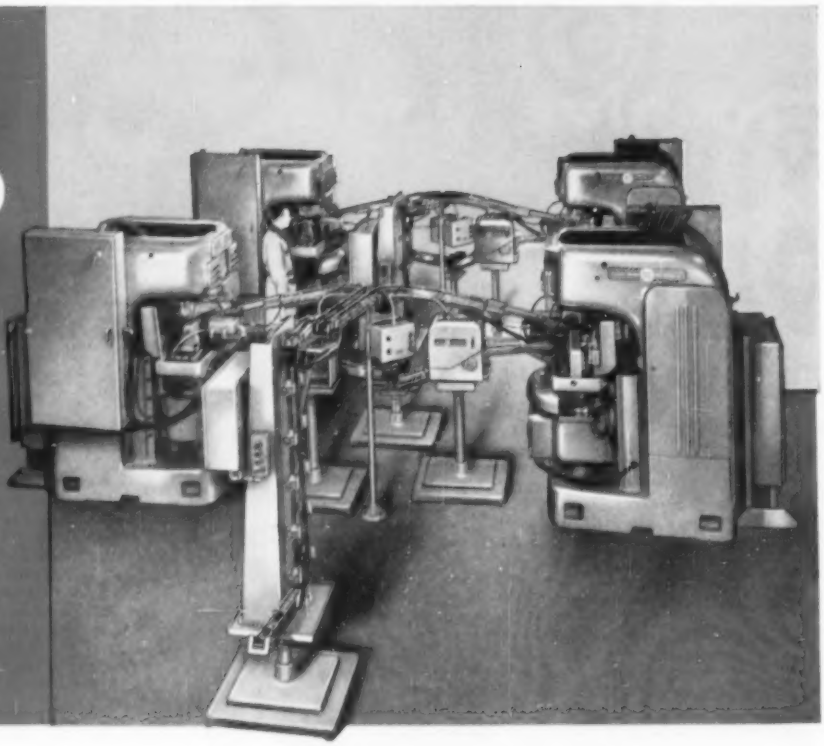
American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

FULLY AUTOMATED GEAR SHAVING CAN ALSO BE PERFECTLY FLEXIBLE



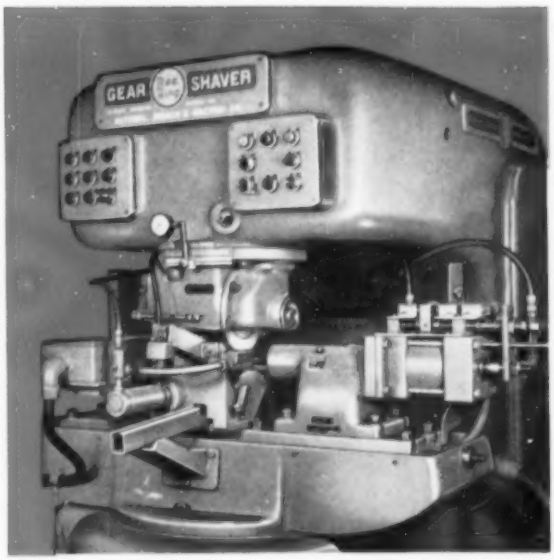
This fully automated installation shaves the split long pinion used in automatic transmissions. This pinion consists of two gear sections each of which is individually crown shaved. Output at full efficiency is 400 pinions (800 gear sections per hour).

The first pair of standard Red Ring Shaving machines processes one of the pinion sections. The second pair processes the other.

Automatic sizing gages perform a 100% check and reject any out-of-tolerance units.

Any individual shaving machine may be stopped at any time for cutter change or adjustment without interferring with the operation of the rest of the system. This is provided for by automatic switching in the feeder lines.

The flexibility of the supply and discharge lines greatly facilitate positioning the machines.



Write for further-details.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

7788

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

5 sure ways

to cut production costs

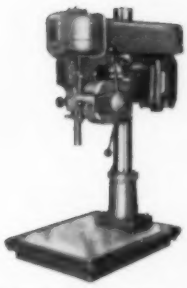
with W-T WALKER-TURNER

"LIGHT-HEAVYWEIGHT"

MACHINE TOOLS

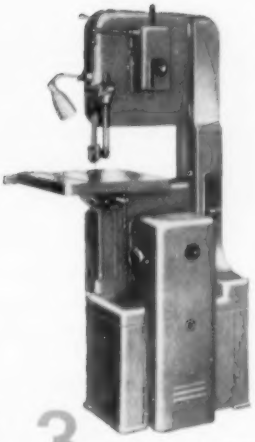
Combining rugged construction, large capacity and unusual versatility, Walker-Turner "Light-Heavyweights" are ideal for a wide range of precision tooling and heavy-duty production operations. Frequently they can be used to replace or supplement larger, expensive machines *and do a better, more economical job*. They can be moved quickly and easily from job to job, yet retain the accuracy and sturdiness of permanently-installed equipment.

Ask your distributor to show you how Walker-Turner tools can make your plant more productive with low initial investment. He's listed under "Tools" in your telephone directory.



1. USE WALKER-TURNER DRILL PRESSES

These "Light-Heavyweight" 20" and 15" drill presses can't be equalled for fast, accurate production drilling. Available in bench, floor and production models—single or multiple spindle.



3. USE WALKER-TURNER BAND SAWS

With its variable speed drive, the W-T 16" band saw can be adjusted instantly, while machine is running, to correct cutting speed for any metal—even tool steel. 14" models also available.

4. USE WALKER-TURNER GRINDERS

Designed to handle your most exacting grinding operations. Complete line includes 7" tool grinder (illustrated), 6" bench grinder, surface grinder, and 6" carbide tool grinder. Portable dust collector also available.

5. USE WALKER-TURNER CUT-OFF MACHINES

This W-T cuts fast, true and clean—frequently eliminates finishing operations. Can be used with abrasive cutting wheels or saw blades for fast cutting-off of metals, plastics or wood.

2. USE NEW WALKER-TURNER RADIAL DRILLS

They give you all the operating features of larger machine tools costing several times as much. Made in 24 models with 4½" or 6" spindle travel. Nothing on the market touches these new radial drills in price or dollar value.

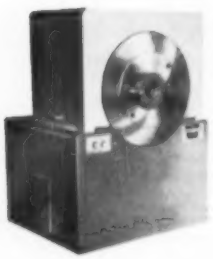
Mail coupon for details on the complete Walker-Turner line!

WALKER-TURNER
Division of Rockwell Manufacturing Co.
Dept. WH-25, 400 N. Lexington Ave.
Pittsburgh 8, Pa.

☐ Please send name of my W-T distributor.
☐ Please send literature.

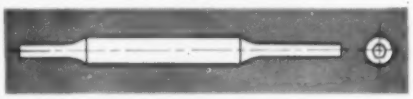
Name_____
Address_____
City_____ Zone_____ State_____

How much are you paying for the machine that isn't there?



Because a Torrington Rotary Swaging Machine shapes work by reduction instead of cutting metal away, many parts you are now machining can be *swaged* in less time, using less material.

Take this steel shaft, originally produced by turning. By using a smaller blank and *swaging* both ends (in 9 seconds), a 37% material saving was realized. Accuracy to ±.001" was secured with unskilled labor!



You can put many operations on a Torrington Swager—pointing, tapering, reducing, sizing, forming inside contours and threads. In a short time, your swaging machine will have paid for itself. If you operate screw machines you cannot afford to be without a Torrington Rotary Swaging Machine.

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THE TORRINGTON COMPANY • Swager Department
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TORRINGTON ROTARY SWAGING MACHINES

Let's CUT COSTS

on these Secondary Operations

- DRILLING
- REAMING
- TAPPING
- TURNING
- MARKING
- PUNCHING
- GRINDING
- ROUTING
- SAWING
- THREADING

High cost second operations can kill first operation profits. If you perform any of the above secondary operations, better take a critical look at how you do it. There may be cost saving opportunities you've overlooked.

If any one of them involves hand feeding of parts or tools—hand clamping—or mechanical means of performing push, pull or lift motions—The Bellows Co. can save you money.

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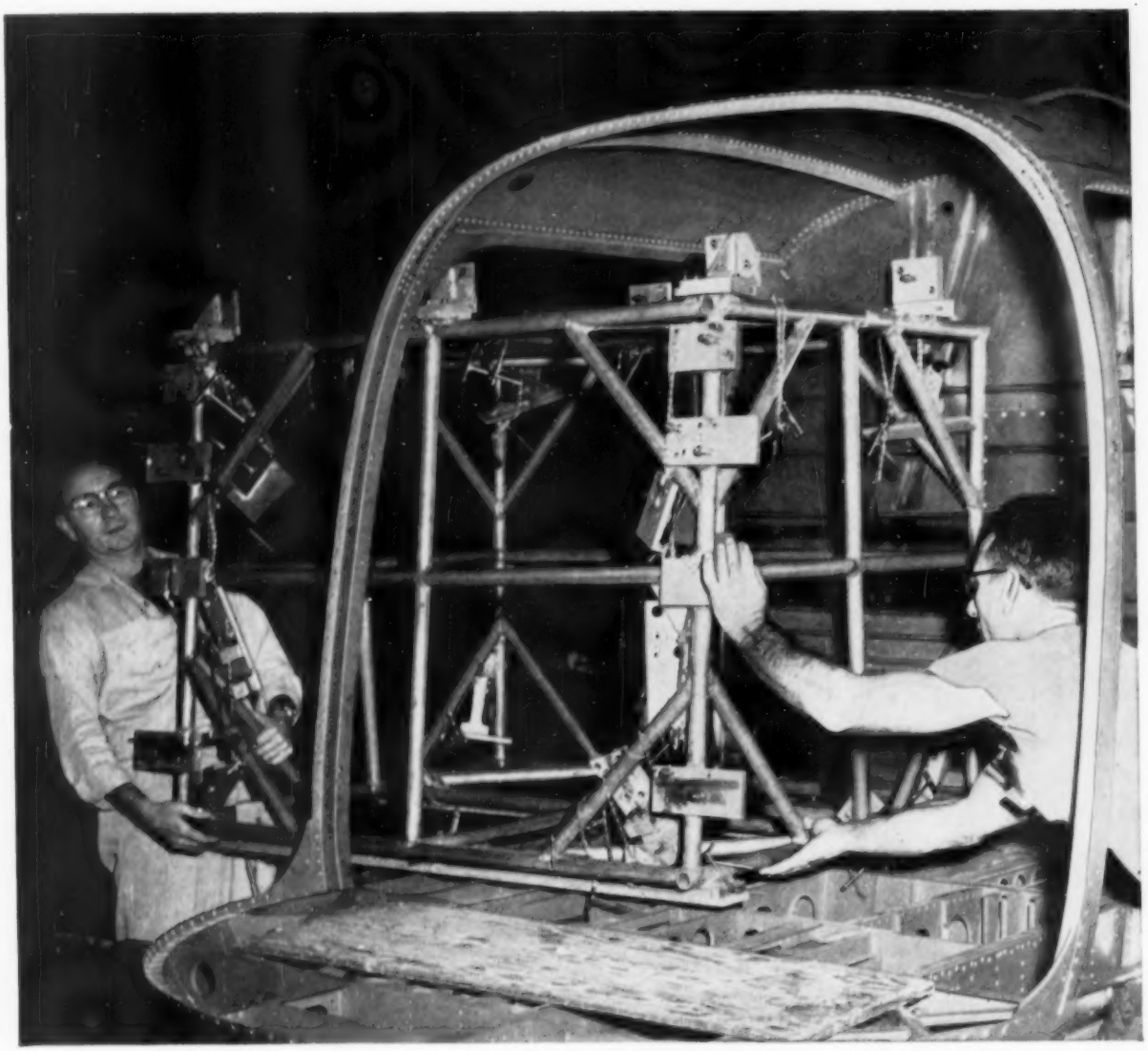

TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

"Light magnesium tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA-1415U-2.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

TWO SIZE RANGES
For Production or Repair

You may not be able to see the difference in these Danly Dowel Pins but it's there and it's a big one when it comes to die making, repair work or equipment production. One is standard size for new work, the other .001" oversize for repair work where the hole has been enlarged. Yes, Danly provides, from stock, two complete ranges of diameters and lengths. You'll be able to meet any job in your shop with exactly the right dowel pin whether it's new work or repair.

All Danly Precision Dowel Pins are made of high-grade steel, hardened and precision ground to ± .0001". They drive without upsetting or expanding. Lead end taper and driving end radius make them easy, simple to use. Modern inspection methods assure uniform hardness, quality and accuracy.

A complete line of Danly Die Makers' Supplies are available from stock at leading industrial distributors and Danly branch assembly plants in all major toolmaking centers.

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PowerGrip "TIMING" BELTS

"Here's how to sharpen the brains of memory machines,"

says Plant Engineer **"GRIP" POWERS**

SCHEMATIC OF U. S. POWERGRIP "TIMING" BELT DRIVE ON BOESCH TOROID WINDER (MODEL SM-C)
(A) ¼ hp motor pulley—3450 rpm, 1¾" diam.
(B) jack shaft pulley—2156 rpm, 2 3/16" diam.
(C) jack shaft pulley—2156 rpm, 2 3/16" diam.
(D) grooved idler—fixed, 1 11/32" diam.
(E) spring loaded idler—1 11/32" diam. attached to spring, compensates for manufacturing tolerances and travel of (F).
(F) spindle head pulley—3800 rpm, 1 11/32" diam. Pulley can be moved 1", in near-flat arc, to set before winding toroid core.
Because of very short centers, small pulley diameters, high speeds and the need for precise control, Boesch selected PowerGrip drives. They have simplified the machine, made it more compact, and more than doubled the life of the drive.
7"
3"
(TB)
(A)
(B)
(C)
(D)
(E)
(F)
(TB)
7"

The "brains" of electronic memory machines are centered in toroids—tiny, doughnut-shaped coils of thousands of turns of tightly wound wire. Winding these toroids requires the utmost precision. That's why Boesch Mfg. Co. (Danbury, Conn.), a leading maker of toroid winders, uses U.S. PowerGrip "Timing"® Belts on their power transmission drives.

U.S. PowerGrip "Timing" Belts have an efficiency of close to 100%. The belts need no lubrication, no maintenance, are more accurate and quieter than drives formerly used and far safer to both operator and machine.

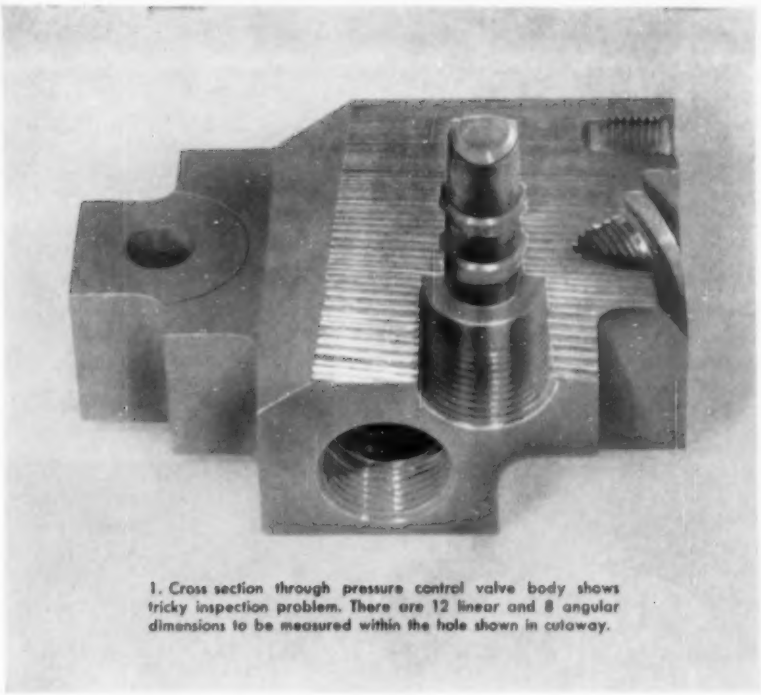
Says the chief engineer of Boesch: "We also use U.S. PowerGrip on our toroidal tape winders and bobbin winding machines. Our engineers and 'U.S.' engineers work hand in hand on *all* our wind-up problems involving power transmission."

A complete line of PowerGrip "Timing" Belt drives—plus expert power transmission engineering assistance—is obtainable at any of the 28 "U.S." District Sales Offices, at selected distributors, or write U.S. Rubber, Mechanical Goods Div., Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Co. Ltd.

Mechanical Goods Division

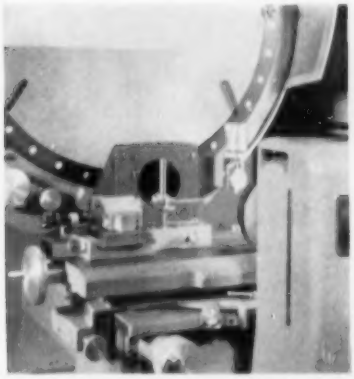
United States Rubber

SEE THINGS YOU NEVER SAW BEFORE; VISIT U.S. RUBBER'S NEW EXHIBIT HALL, ROCKEFELLER CENTER, N.Y.

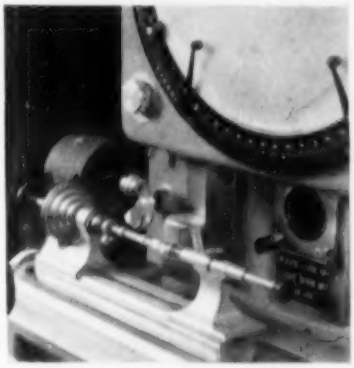


1. Cross section through pressure control valve body shows tricky inspection problem. There are 12 linear and 8 angular dimensions to be measured within the hole shown in cutaway.

2. Part of the receiving inspection department of the aircraft components plant. Model 30 Contour Projector is at the left. Operators work comfortably in normal lighting.



3. Close-up of Model 30 shows tracer fixture and pantagraph. The tracer fixture follows the contours of the hole and translates them into an image on the screen for accurate gaging.



4. In another application, a Kodak Contour Projector, Model 4, is used with a jeweler's lathe, which enables the operator to grind the radii on a servo mechanism piston to a tolerance of .0005" by watching the magnified image during grinding.

2/3 cut in gaging time

helped prove how 23 more Kodak Contour Projectors would return their cost inside 12 months

A leading manufacturer of aircraft components recently purchased 23 Kodak Contour Projectors when cost studies showed the machines *would pay for themselves in 12 months.*

The studies were based on the time and labor saved by Kodak Contour Projectors in inspection of parts like the pressure control valve body pictured above.

This component has 12 linear and 8 angular dimensions to be checked—*all inside a blind hole.* With a Kodak Contour Projector, Model 30, inspection of 25 pieces takes just 3½ hours. Formerly, the same job took 10 hours and was less accurate. Hundreds of manufacturers across the country have had similar experiences with all sorts of complex parts, large and small.

Whether your problem involves receiving, production, or final inspection, there's a Kodak Contour Projector to do the job quickly, accurately, and at low cost. To learn more about how optical gaging can work for you, send for your copy of the free booklet "Projection Gaging with Kodak Contour Projectors," or write for the name of the representative in your area. No obligation, of course.

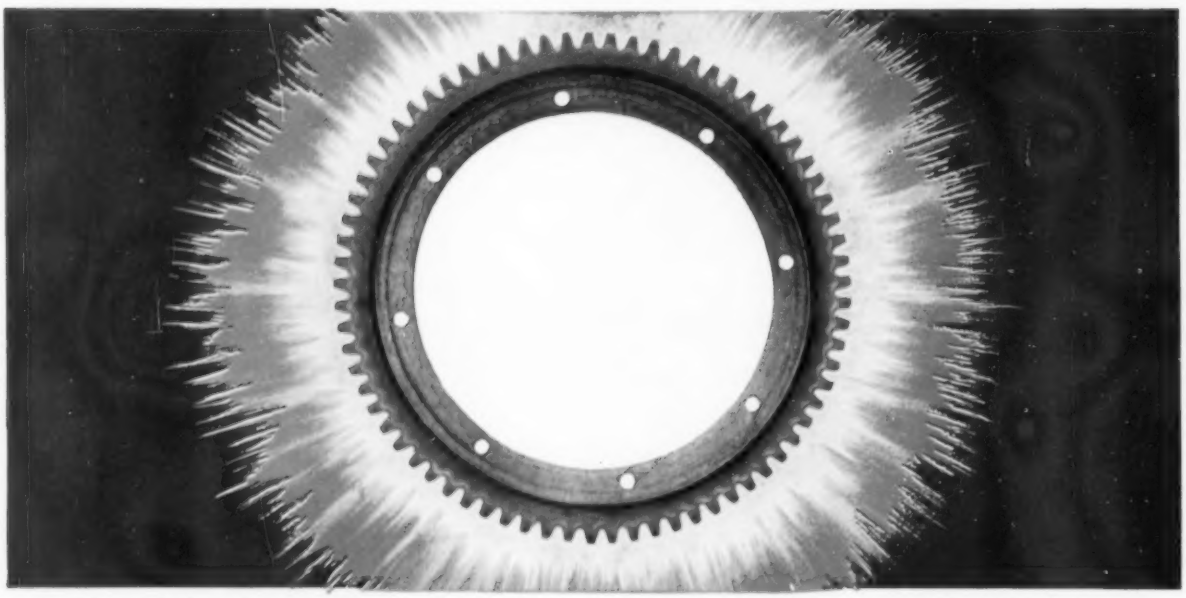
EASTMAN KODAK COMPANY, Rochester 4, N. Y.
Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

IH Saves $82,507 Per Year

with TOCCO Induction Hardening*



Gears, shafts, pins, wheels, tubes and bars—almost any size or shape of part—or any metal, too—is adaptable to TOCCO hardening, brazing, annealing or heating for forging.

Production Up—Engineers at the Milwaukee Works of International Harvester Company have adopted TOCCO for hardening final drive gears for famous International Harvester farm tractors. TOCCO increases production on the gear shown here from 14 to 35 per hour, 250% faster than conventional heating method, reduces job from a 3 shift to 2 shift operation, even with increased production schedule. Heating time is 35 seconds; oil quench, 60 seconds.

Costs Down—TOCCO cuts cost—saves $82,507 per year on application shown above. TOCCO makes possible use of C-1050 A.R.R. steel instead of expensive A-8645-H alloy steel previously required. TOCCO also eliminates shot-blast, formerly needed to remove scale, and extra machining operations that used to be necessary to compensate for distortion.

Gear shown is 18½" O.D., width of face is 2", weight 34 pounds, 73 teeth. Hardness obtained is 55-66 R.C., using 140 K.W. of 10,000 cycle power.

Our Engineers can probably find applications in your plant where TOCCO can increase output and reduce unit costs.

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The Ohio Crankshaft Co. • Dept. G-8, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating".

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Vacation Time!

At this time of year, most tool engineers are taking a well-earned vacation. The vacation period is a delightful time of year because we spend it with our families. It can also be a time for creative thinking. Our best ideas come to us during leisure hours. Tool engineers have the habit of observation and their minds are trained to think constructively.

The horizons of the engineering field are such that the individual tool engineer cannot confine himself to a narrow field; his creative thinking may deal with research, education, standardization and other areas of management. Vacations free him from his day-to-day routine, enabling him to channel his thinking along broader lines.

For ASTE members, summer is also a time of vacation from regular chapter meetings. This vacation makes it possible to concentrate on over-all planning for the meetings which will start in the fall. Chapter program chairmen and their committees have found that creative thinking and hard work during the summer pay off in terms of successful meetings.

In keeping with the broader aspects of engineering, many chapters plan meetings on the subject of education of engineers, with particular emphasis on the problem of attracting students to an engineering career.

The end result of a tool engineer's using a portion of his leisure for creative thought is professional progress, which means a better standard of living for himself and his family. Multiplied by 38,000 tool engineers, this kind of thinking means a better standard of living for everybody in the country.

Here's wishing you a pleasant, safe—and creative—vacation.

H E Collins

PRESIDENT
American Society of Tool Engineers

What's the lowest cost way to produce steel parts like these?

You may be paying considerably more than you need to for parts like these if you aren't taking advantage of Ryerson flame-cutting service.

Size makes no difference—nor intricacy of shape. You can order one part or one thousand and get quick delivery of steel cut to close tolerance—with almost die-cut accuracy from piece to piece. And here's where the saving comes in:

1. **No dies or molds** are needed so you save this cost when you switch from cast or forged parts to flame-cut parts.
2. **Less machining** is usually required to finish a flame-cut part. Sometimes machining is eliminated altogether.
3. **Freight costs lower**—If you're now paying freight on steel you later scrap you may well be able to pay for flame cutting with the money you save by shipping lighter flame-cut parts. The blank for a 6" disc is 49% heavier than the disc itself. Storage and handling expenses are reduced, too.
4. **Less time in process**—You can often convert finished products into cash more quickly because parts can be produced faster by flame cutting.
5. **No loss on spoilage or rejects**—They're our problem—not yours.
6. **Design changes are simpler** and can be made more frequently without sacrificing manufacturing economy.

You draw on the nation's largest steel stocks at Ryerson—and unequalled flame-cutting facilities are ready to work for you. A blue print or sketch with clearly marked dimensions is all we need for prompt handling of your requirements. Call your nearby Ryerson plant for cost-cutting flame-cut steel today.

In stock: Carbon, alloy and stainless steel—bars, structurals, plates, sheets and strip, tubing, re-bars—industrial plastics, machinery & tools, etc.

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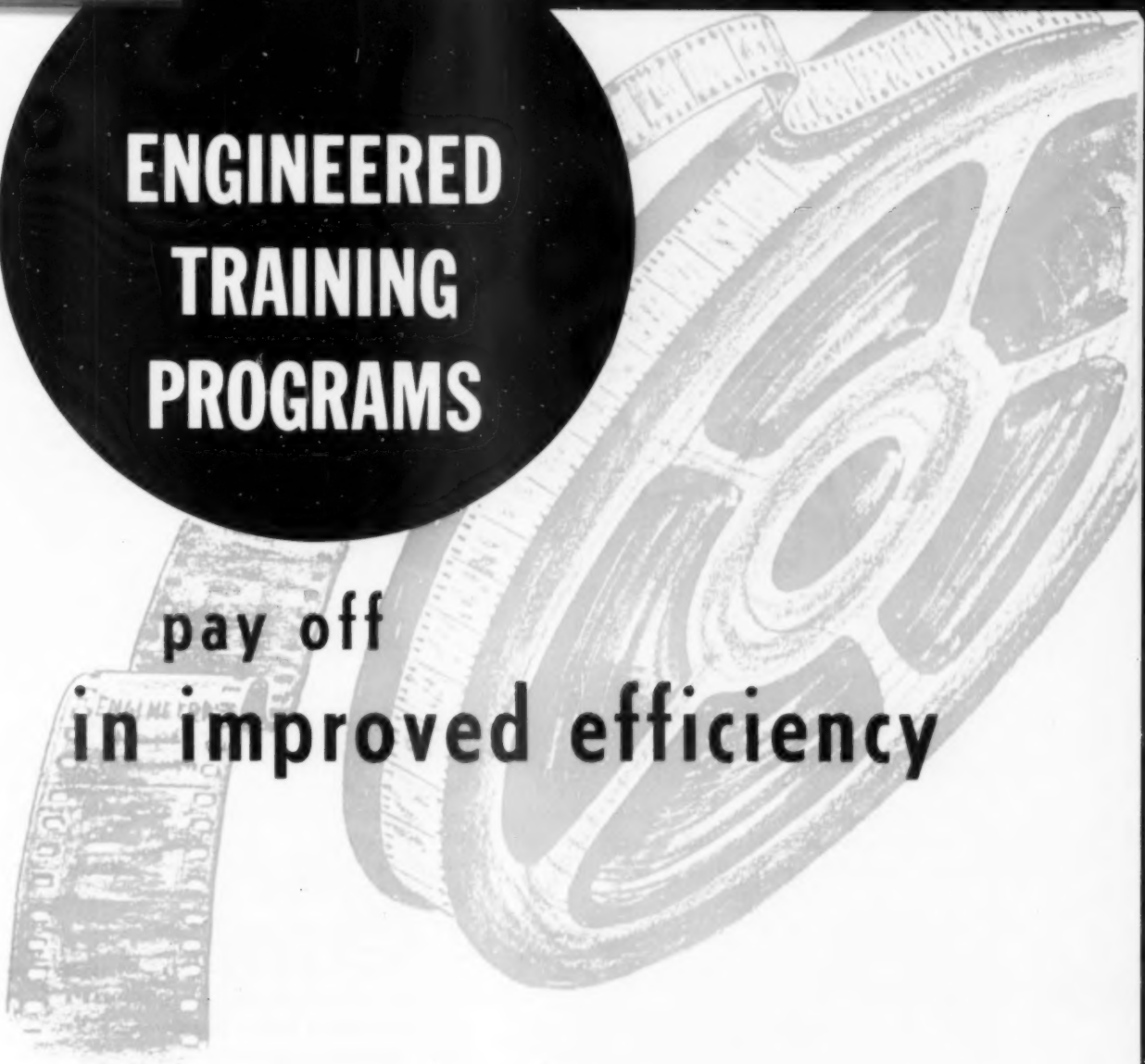
ENGINEERED TRAINING PROGRAMS pay off in improved efficiency



By C. L. Fanning*

Assistant Chairman
Machine and Woods Shops
General Motors Institute
Flint, Mich.

Technical, operating and training personnel pool their experience at General Motors to develop organized training programs. This article describes how a company team engineered a successful program which, when presented at several divisions, reduced carbide tool costs by millions of dollars.

ADEQUATE EMPLOYEE TRAINING pays off in terms of more efficient manufacturing operations. This fact has been proved time and again at General Motors, where training programs reach every employee. The individuals enrolled in training programs include engineers, supervisors, cooperative engineering students, plant technicians, job setters, apprentices in the skilled trades and production workers.

All such training programs originate within the operating divisions. The management of each division and plant determines the type and extent of training required to solve specific operating problems. Many divisions have the necessary facilities and personnel to conduct their own training programs. Others call upon General Motors Institute for assistance in developing and presenting training material. The training activities of the institute, which is the central training agency for the corpo-

*Senior member ASTE Saginaw Valley chapter.

When price tags were placed on broken carbide tools at Buick, the need for corrective action was self-evident.

ration, reach some 30,000 to 40,000 employees each year.

At the institute, an engineering approach is used in developing training programs. There are six steps in developing a program:

- Planning
- Designing
- Writing
- Reviewing
- Revising
- Testing

These steps are similar to those followed in the development of a new model automobile or similar product. They can best be illustrated by following the development of a typical employee training program at Buick Motor Division.

One of the major manufacturing problems at Buick was the high rate of destruction of carbide tools. A standing tool committee had collected several hundred broken tools and placed a price tag on each. The dollar amount represented by those tools was substantial. Although, in the course of time, tool breakage could be reduced by supervision and tool engineers, it was felt that the urgency and magnitude of the problem called for broader action. Tool breakage, the committee decided, could be substantially reduced by training foremen—the individuals directly responsible for the efficiency of metal-cutting operations—in the correct application and use of carbide tools.

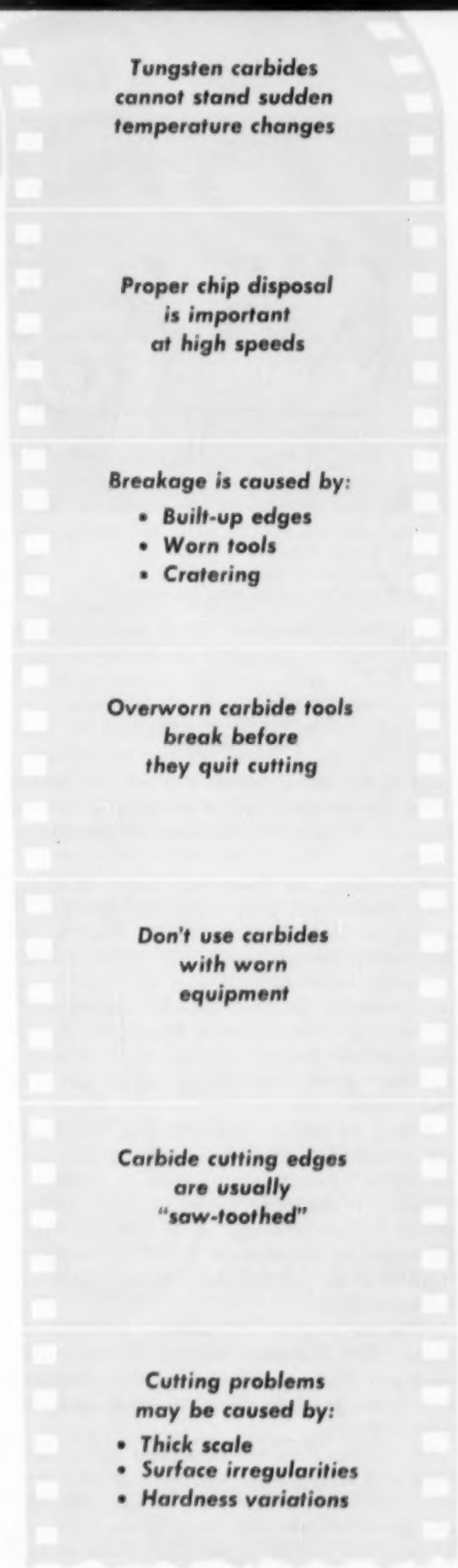
The committee stated the objective of the program as: "To give selected foremen an appreciation of the value of carbide tools; to explain the properties and application of carbide tools and the problems encountered with them, so that the foreman can help his operators to better utilize carbide tools." With this objective established, the division asked the institute to plan a training program to put it into effect.

Planning: There are three steps involved in planning a training program:

1. Determining the needs of the trainee
2. Setting training objectives
3. Selecting individuals as members of the team which will develop the program.

Several kinds of background are required to develop a training program: technical information, operating knowledge and training technique. Each of these kinds of ability was represented on the committee selected to develop the carbide training program. The group was a well-balanced team, and included an engineer active in tool research, a tool

Technical experience, operating experience and training experience are pooled in the committee which develops the training program.


Tungsten carbides cannot stand sudden temperature changes
Proper chip disposal is important at high speeds
Breakage is caused by:
• Built-up edges
• Worn tools
• Cratering
Overworn carbide tools break before they quit cutting
Don't use carbides with worn equipment
Carbide cutting edges are usually "saw-toothed"
Cutting problems may be caused by:
• Thick scale
• Surface irregularities
• Hardness variations

Typical subtopics of Session Four—Tungsten Carbide Limitations and Problems.

supervisor, a research metallurgist, two general foremen, a metallurgical engineer, a training director from the personnel department, several members of the program development section of the institute, several members of the faculty who had past experience in carbide tool training and proven writing ability, and other specialists.

Designing and Writing: The committee was responsible for developing a blueprint for the entire program. Once the blueprint was prepared, it was turned over to writers from the institute, who prepared a first draft of the training materials. In preparing the draft, which included teaching and learning aids, the writers applied creative thinking to the program outlined by the committee, organizing the materials into a sound teaching sequence.

Review and Revision: Following development of the initial draft, it was reviewed to see whether or not the writers had accurately interpreted the blueprint. This review was performed by the same individuals who participated in designing the program, since they were most familiar with the specifications. A number of revisions were suggested.

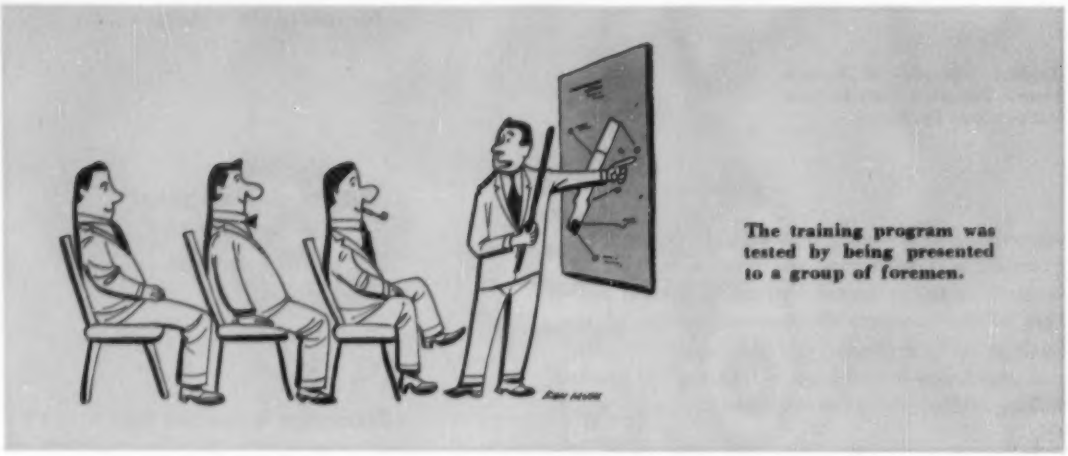
Testing: Once the revisions had been made, the program was presented to an initial group of foremen who supervised carbide tool operations. Members of the program development committee sat in on the classes as observers. In the light of the experience gained in presenting the program, some of the course content and training methods were revised and several training tools were adopted, including leader's guides, a carbide tool manual and visual aids.

Program Content: As finally approved, the program comprised six topical units, each presented as a one-hour session. The sessions covered:

Session One
- Explanation of program objective
- The nature and characteristics of tungsten carbide

Session Two
- Factors which must be considered to get greatest efficiency from carbide tools
- Tool design
- Carbide grades

Session Three
- Correct feeds and speeds



The training program was tested by being presented to a group of foremen.

SESSION FOUR
- Limitations of tungsten carbides
- Ways of overcoming these limitations

SESSION FIVE
- Fabrication, reconditioning and handling of carbide tools

SESSION SIX
- Causes of common tool troubles
- Summary of program material.

Each of the major discussion topics was broken down into subtopics. Typical subtopics for Session Four are shown in the accompanying illustration.

Presenting the Program: Every effort was made to avoid an "ivory tower" approach in presenting the material in the course. Prior to the first session given to each group of foremen, the discussion leader spent at least two days in the plant, observing practices connected with the handling and use of carbide tools. When a specific job was mentioned during a training session, the leader was often familiar with that job and any attendant tool troubles.

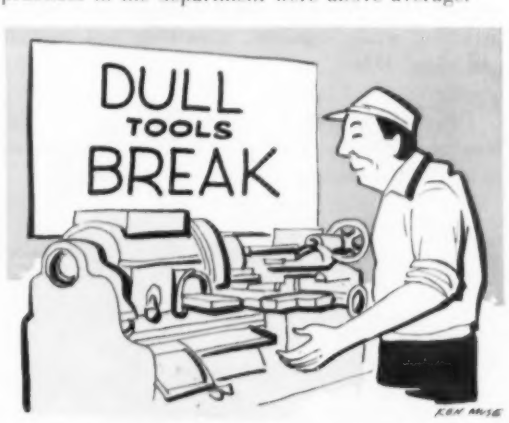
During the session, remarks such as, "the breakage on this tool can't be prevented—we have tried everything," were frequently made by production foremen. At that point the leader would arrange to visit the job, preferably on the same day. Often he would be accompanied by a tool engineer. Analysis of the job frequently resulted in specific recommendations.

When the program was presented at various divisions, there were many examples of improvements made as a result of such analyses. Often, the solutions to the problems resulted in much more efficient operation.

In one case, there was rapid wear on the tooth edges of a milling cutter and breakage was excessive. Two cutter changes per shift were necessary and production was only twenty pieces per hour. The machine was set up for conventional milling, but was adaptable for climb milling. This led to the suggestion that climb milling be tried out. Climb milling made it possible to run cutters for an entire shift without replacement, eliminating the temptation to operate with a dull cutter. Tool breakage was reduced and it was found that feeds and speeds could be substantially increased. The climb milling production rate was thirty pieces per hour.

In another instance, one of the tools used in a tool block for cutting ring grooves in aluminum pistons was subject to such rapid wear and breakage that it was replaced hourly. This tool was of the same design as those previously used to machine cast-iron pistons. After analyzing the problem, the tool was redesigned for cutting aluminum and a different grade of carbide was tried out. The new tool ran for several days before replacement was necessary.

Again, the reason why a particular brazed-on turning tool was cracking in a cutter grind department was a mystery. The cracking was a new condition; no trouble had been experienced with the tool previously. General grinding and handling practices in the department were above average.



As part of the program follow-up, basic rules for efficient use of carbides were posted throughout the plant. These reminders proved effective.

If Tools Chip, Crack or Break

Check	
1. Chip breaker	Too narrow or too deep
2. Work surface	Rough, scale or dirt
3. Clearance or rake	Excessive
4. Feed	Too heavy
5. Coolant	Improperly applied
6. Overhang	Excessive
7. Rigidity	Loose tool, work or machine
8. Tool dullness	Excessively worn cutting edge
9. Speed	Too slow

If Tools Wear Rapidly

Check	
1. Center	Cutting edge not on center line
2. Feed	Insufficient, causing rubbing action
3. Chatter & vibration	Excessive
4. Nose radius	Too large

Tools Other Than Carbide

Although carbide tools require very careful handling because of their brittle nature, it is equally important to handle all other types of tools with care.

Remember, the function of the tool is to control the size and accuracy of the parts you are producing. The tools are made with precision from expensive materials and deserve your utmost care.

Pocket-sized oilproof card distributed to machine operators by foremen during informal training sessions.

After some detective work, it was discovered that cracking occurred when an operator placed hot tools on a window ledge to cool after grinding. The window was partially open and exposure to near-zero air caused the tools to crack, sometimes with an audible snap.

Implementing the Program: No training program, no matter how carefully prepared and presented, is of any lasting value unless it results in constructive action by those being trained. Further, it should be followed up in some way so that the information presented is not soon forgotten.

Follow-up was handled in two ways. First, key points from the program were printed on attractive signs posted in conspicuous locations in the plant. Second, each foreman who participated in the program received a handbook containing all the text material covered, plus additional information which might be useful on the job. He was also given a quantity of pocket-size oilproof cards for distribution to all machine operators under his supervision. The general rules for successful application of carbide cutting tools were listed on the cards. These cards were used by the foremen in conducting informal training programs of their own. To facilitate further study, samples of informational material distributed by machine and cutting tool manufacturers were shown to all foremen, and they were told how to obtain additional copies for their own use.

Evaluating Program Results: It is sometimes difficult to evaluate the results of a training program, but in this case there were a number of indications of success. The first evidence came from the comments of foremen who took the course. One said, "All the foremen have become more conscious of tool problems and are seeing things they did not see before." Another reported, "After the first two sessions, breakage was eliminated on a job that had been troublesome for a long time."

Perhaps the best indication of the success of the carbide training program, however, was the fact that management of seven other divisions asked that it be presented in their own plants.

Plant management has been enthusiastic about the results of the program. The works manager in one plant wrote that he was sure the program had been the major reason for a reduction in tool costs amounting to $100,000 in the three months following the presentation. More recently, tool costs in another plant were $7.50 per product unit before the program was presented. Three months afterward, they were ranging from $3.40 to $3.30 per unit per month.

Much of the success of the program is attributable to the fact that it was developed to solve a specific problem and designed to fit the needs of the group in closest daily contact with that problem. A similar engineering approach to the development of training programs will give equally good results in solving manufacturing problems in other plants.

We are living in an extraordinarily creative age. The impossible of yesterday becomes possible today and the reality of tomorrow.

We shall achieve interplanetary travel. The chemist and physicist will develop new fuels. The metallurgist will develop new heat-resistant metals. The aerodynamicist will solve the problem of airless flight. The instrument specialist will devise the most complex navigational equipment. But no one will manufacture and apply these inventions without the help of machine tools—the true bedrock beneath the foundation of progress.

Louis Polk
Past President, National Machine Tool Builders Association

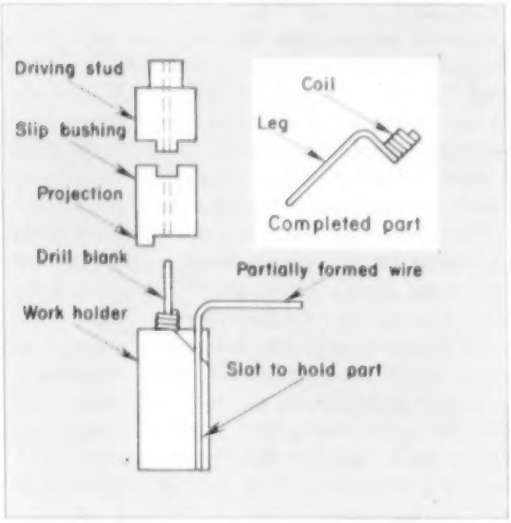
Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Making Wire Parts on a Drill Press*

When making small quantities of formed wire parts, tooling costs must be held to a minimum since these costs can be spread over only a limited number of parts. The tooling illustrated gives good results at minimum costs. It is designed for use with a drill press.

The tool consists of a driving stud held in a drill chuck, a hardened slip bushing with a projection which acts as a forming tool, and a work holder. Length of the work holder, which is held in a vise clamped to the table of the drill press, is equivalent to the length of the leg of the part. A drill blank at the top of the work holder acts as a mandrel for forming the coiled portion of the wire. OD of the drill blank is the same as the desired ID of the coil. The hardened bushing is a sliding fit on the drill blank.



To make a part, a length of wire is first inserted in a slot in the work holder and bent manually 90 degrees as shown in the illustration. The end of the wire is then swung around clockwise and raised slightly to come in contact with the drill blank. Next, the slip bushing is placed on the drill blank so that the projection on the bushing contacts the wire. The drill press spindle is brought down so the driving stud engages the slip bushing. A few turns of the driving stud are sufficient to form the part. The slip bushing must be removed after making each part. A coil spring at the base of the drill rod aids in ejecting parts after forming.

While this type of tooling is not suitable for precision parts, it is entirely satisfactory for the tolerance requirements of the part illustrated. With a little ingenuity, similar low-cost tooling can be designed for other small wire parts.

Chester Paff
Monmouth Chapter

*Gadgets Contest Entry

Alignment Test Mandrel*

Accurate machine tool spindle alignment is essential for precision work. The alignment test mandrel shown, *Fig.* 1, can be used in measuring the concentricity of a machine spindle taper and its turning axis, and also in measuring the squareness of the spindle relative to the surface of the machine table. Essentially, the mandrel consists of a steel bar which fits into the machine spindle. The mandrel illustrated is approximately 16 inches long; however, other lengths may be required to fit specific machine dimensions. Since variations in the mandrel geometry would affect test measurements, all areas are machined to close tolerances.

The mandrel is equipped with a nut mounted on a threaded area close to the Morse taper shank. This nut is turned to eject the mandrel from the machine spindle, eliminating the need for a drill drift or some other implement which might cause damage.

In *Fig.* 2, the mandrel is shown mounted in the tapered socket of machine spindle. Twelve inches below the end of the socket a standard dial indicator and stand are being used to measure the runout at the end of the mandrel. One-half of the meas-

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.

ured runout is equivalent to the eccentricity of the spindle socket and spindle turning axis. A standard swivel and extension bar, equipped with a dial indicator, are used to measure the squareness of the spindle relative to the machine table, *Fig.* 3. Several readings are taken at different points around the axis of the machine spindle.

The two alignments tested are critical in the successful performance of a machine when set up with a drill jig or fixture. By using the mandrel, spindle and table alignments can be readily checked.

Norman F. Snyder
Saginaw Valley Chapter

***Gadgets Contest Entry**

Fig. 1. Alignment test mandrel and nut.

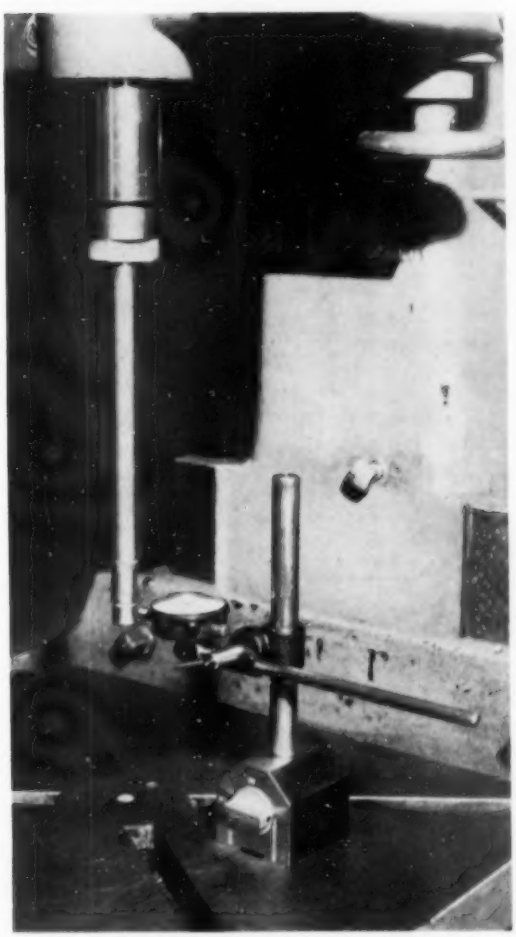


Fig. 2. Mandrel being used to check runout.

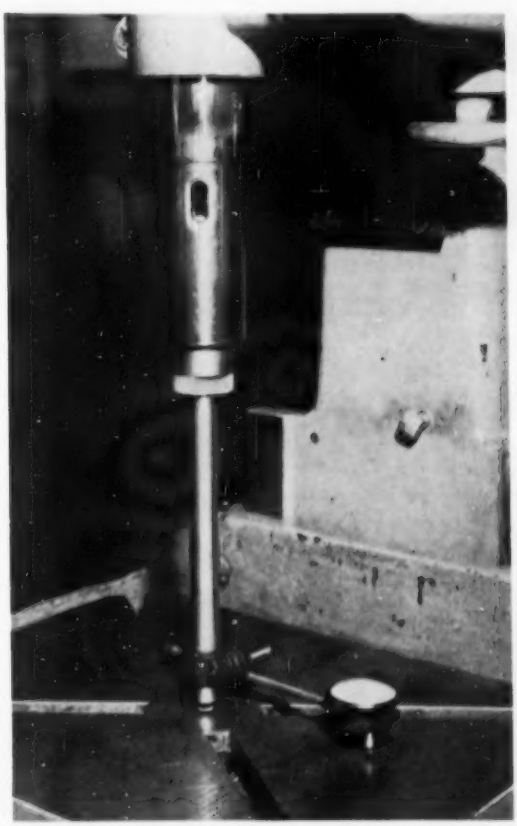


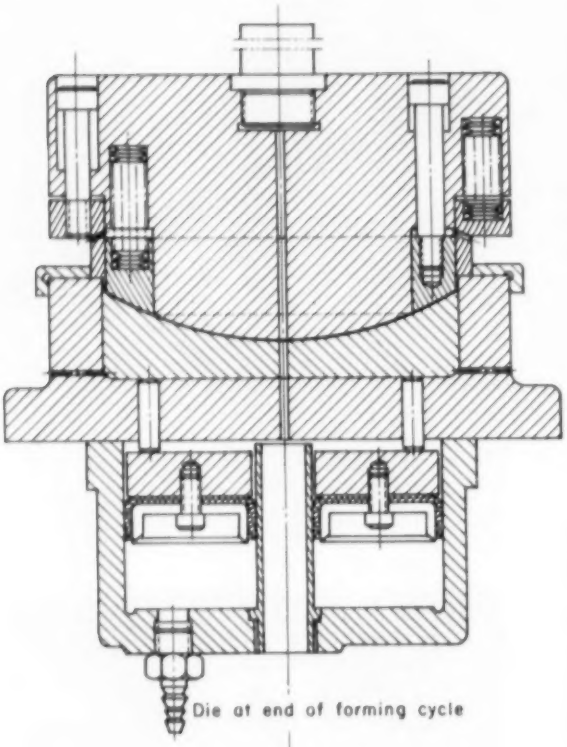
Fig. 3. Checking relationship between machine table and spindle axis. Indicator is swung around mandrel to obtain readings at several points.

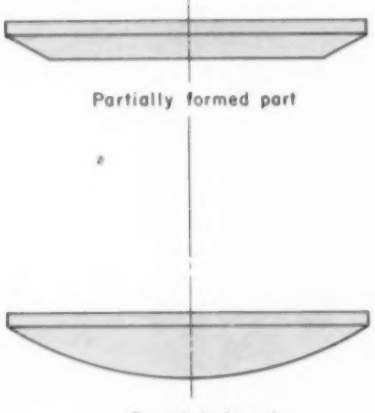
Triple-Action Drawing Die

Sheet metal parts like the one illustrated are usually formed in two separate drawing dies. It is possible, however, to form such parts in one combination die, if a means for holding the blank for the initial drawing operation can be devised.

This is accomplished in the die shown by using a blank-holder ring actuated by eight compression springs. The ring is a sliding fit on the drawing punch. When the press ram descends, the blank-holder ring, acting as a punch, performs the first forming operation. As the ram descends further, the second forming operation is completed. Pressure between the blank-holder ring and the drawing die holds the edges of the part in place. The part is ejected by pins actuated by an air cylinder device, which lifts the drawing die.

Hjalmer Dahl
Uplands Vasby, Sweden





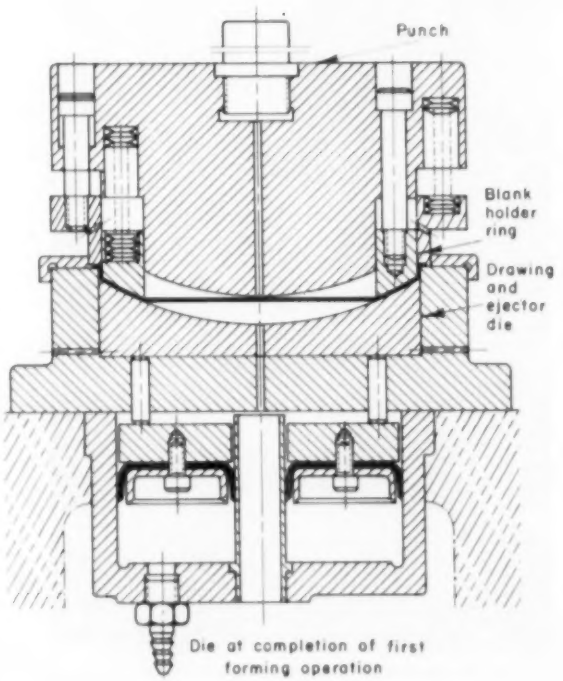


Fig. 1. Inspector computes exit area in a first-stage-stator assembly by totalling length and width measurements for each opening. This averaging air gage was developed by Federal Products Corp.

How to Control GAGING COSTS

. . . one company's methods

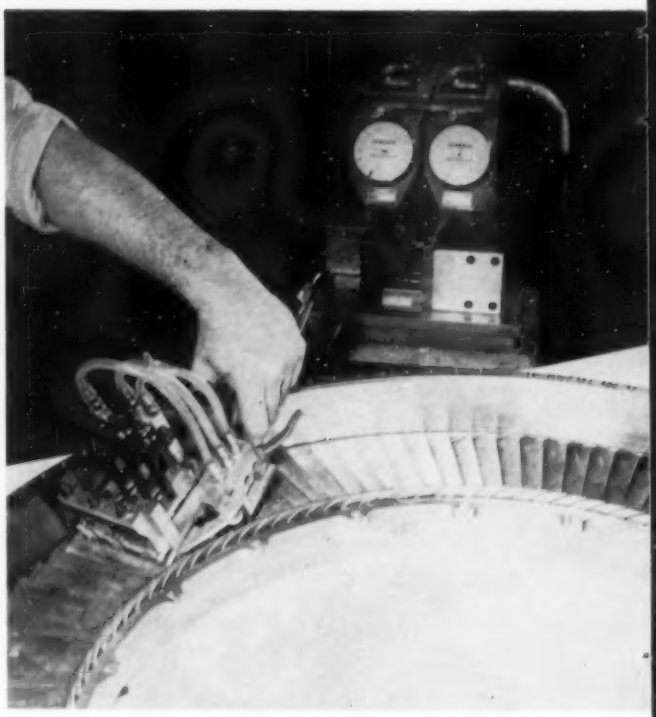
By Henry Kleiber

Chief Inspector of Gage Engrg.
Wright Aeronautical Div.
Curtiss-Wright Corp.
Wood-Ridge, N. J.

ALL MACHINE SHOPS have the common problem of keeping inspection expenses down. These encompass the cost of gages and the cost of inspection time. Because of the scope of operations at the Wright Aeronautical Div. of Curtiss-Wright Corp., both job-shop and mass-production gaging problems are encountered. Over the years, formal policies relating to gaging equipment have been developed and organizational responsibilities have been assigned to make certain that these policies are carried out.

At W.A.D., the manufacturing engineering department is responsible for the design and procurement of gages. Since manufacturing engineering is primarily concerned with production, rather than inspection, problems, a group of gage specialists has been established as part of the quality control department. These coordinators make sure that

Fig. 2. Exit area width measurements are made at three points simultaneously and averaged as one reading, and length of the opening is shown on the second air gage of this inspection unit.



gaging equipment is designed to check the conformity of a product with engineering drawings, and that functional and assembly considerations are taken into account in gage design. The objective is to determine what type of gage will provide optimum accuracy, economy and efficiency for checking a given product.

This approach is used whether the gaging problem appears to be simple or complex. Often, a fixed-limit gage or a standard mechanical dial indicator is capable of performing all necessary inspection operations. In other cases, where tolerances are close, complex special air gages, *Fig.* 1, or electronic gages are required.

Factors in Gage Selection: In addition to the nature of the dimensions being checked, the quantity of parts to be inspected in a given period of time must be taken into consideration. The coordinator must prevent potential production delays by providing fast, accurate and reliable equipment where production quantities are large and have a uniform flow. The least expensive gage that will suit the purpose is used.

In determining whether a gage is suitable, the gage coordinator must also consider part-material characteristics. For example, is the part flexible and would this flexibility affect gage application and gaging accuracy? Must it be rounded up before checking? Part design, material and manufacturing methods should also be studied carefully.

If the inside diameter of a hole in a soft material is to be inspected, for example, a dial bore gage might not be usable because it could score the surface. An air gage would probably be used to prevent gaging contact with the surface. For harder surfaces, a bore gage or even a fixed-limit gage might be acceptable. If part tolerance were close, the choice would probably be restricted to an indicating bore gage.

At the same time they determine mechanical suitability of a gage for a specific operation, coordinators consider the economics of the inspection operation. The number of parts to be gaged may influence a gage-selection decision. For small or medium production runs, the simplest gage is usually the most economical—if it has the necessary accuracy. For long runs, it is frequently possible to design multiple gages to simultaneously inspect several characteristics.

As soon as the gage coordinator approves the proposed standard gage or design, the manufacturing engineering department procures those units that are standard. In the case of a special gage, Manufacturing Engineering proceeds with its design or contracts for the design service of a gage manufacturer. To assure the best practical design, gage coordinators work closely with the tool engineers, the gage manufacturer or both.

Gage Use Policies: As this gaging control program was developed, gaging policy also was established. At present, W.A.D. policies include specification and application of fixed-limit, dial-indicator and air gages.

While the indequacies of fixed-limit gaging are recognized—accuracy is limited by operator's sense of touch, usefulness only for fairly large tolerances and no indication of actual part size—they still fill a definite need. They help minimize initial gage cost for parts made in small quantities and to relatively low degrees of precision.

Gaging policy on fixed-limit gages calls for unilateral tolerances on "go" plugs and bilateral tolerances on "not go" plugs. On a "go" plug, the gagemaker's tolerance and the wear allowance are added to the nominal gage size. The "go" gage, therefore, varies in size from the minimum product dimension to somewhat larger than minimum size.

Applying unilateral tolerances thus takes some of the product tolerance. The disadvantage is that the shop must work to a smaller tolerance than specified by the design engineer. The advantage of this policy is that part size is held close to the center of the part tolerance.

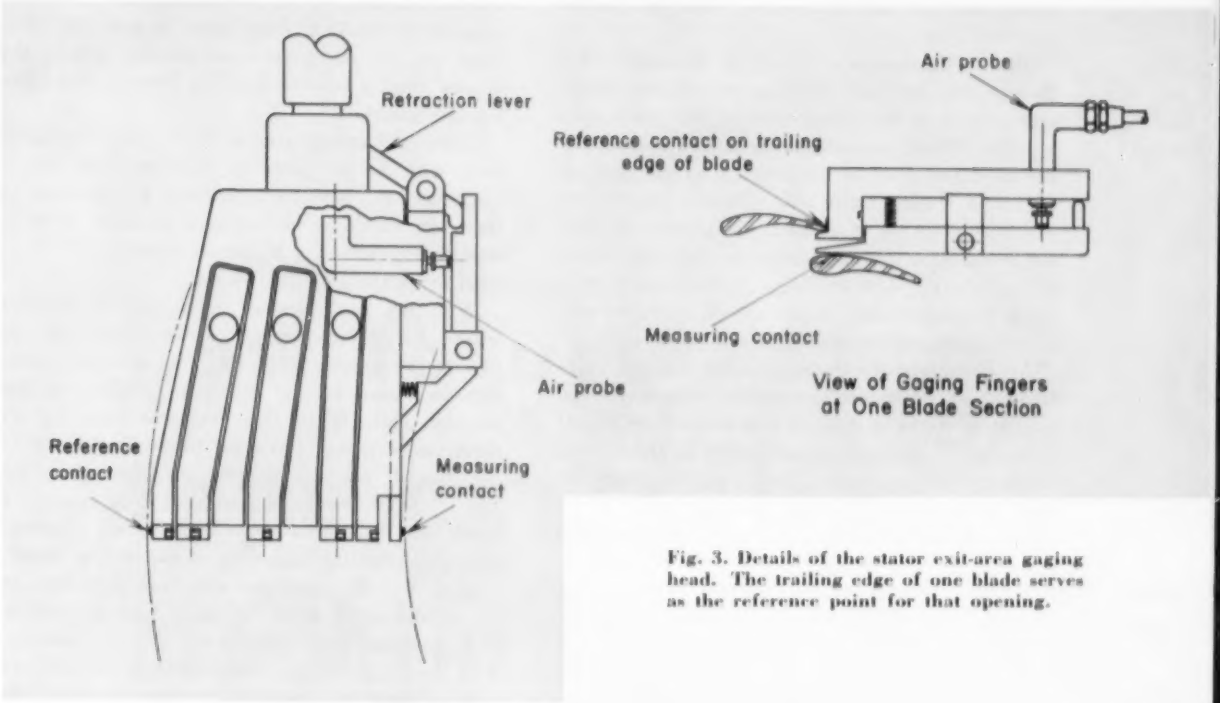


Fig. 3. Details of the stator exit-area gaging head. The trailing edge of one blade serves as the reference point for that opening.

Bilateral tolerances on the "not go" plug straddle the low and high limits of part tolerance. The gagemaker's tolerance and the wear allowance are split equally plus and minus on maximum part size. The "not go" plug, therefore, may actually accept parts that are slightly beyond limits, since it varies from a size slightly smaller than the maximum part size to somewhat larger than the maximum size.

With fixed-limit gaging, W.A.D. policy specifies that plug and ring gages are not normally to be applied for tolerances ± 0.0005 inch or less. Large plugs and rings—from 1.0000 to 6.0000 inches in diameter—should not be used for tolerances less than ± 0.001 inch. Fixed-limit snap gages may be used for tolerances of ± 0.001 inch or greater for dimensions up to 6 inches and ± 0.002 inch or greater for dimensions from 6 to 12 inches.

Parts with closer tolerances are necessarily gaged by indicating instruments. Indicating gages supply more information on the dimensional characteristics of parts and avoid variations caused by the human sense of touch. They give consistent results since the ability to read properly designed dials varies little among experienced personnel. The precise information obtained immediately shows the operator whether the machine is drifting in either direction—toward oversize or undersize parts—so he can resharpen tools or make other necessary adjustments to keep parts within tolerances.

There are a number of factors that guide the selection of an indicator gage—mechanical, air or electronic. These include: gaging requirements, degree of control (precision to which the part must be gaged), versatility and cost. Many engine parts, however, regardless of the number to be produced, require the use of air or electronic gages because of the accuracy required. Dial indicators are used where possible because of their lower initial cost.

A Case History: Initial cost of gaging equipment is not the only cost that should be considered in selecting gages and methods. Time that the operator or inspector spends on gaging may be a governing factor. The influence of gaging time can be illustrated by comparing two gaging methods for inspecting the first stage stator of a jet engine. This particular inspection operation is required to determine the total exit area between blades.

The original gaging method used a dial indicator gage that measured width and length of the exit area between pairs of blades. Three measurements of width and one measurement of length were made, or a total of four readings per opening. Inspection by this method took eight hours per stator.

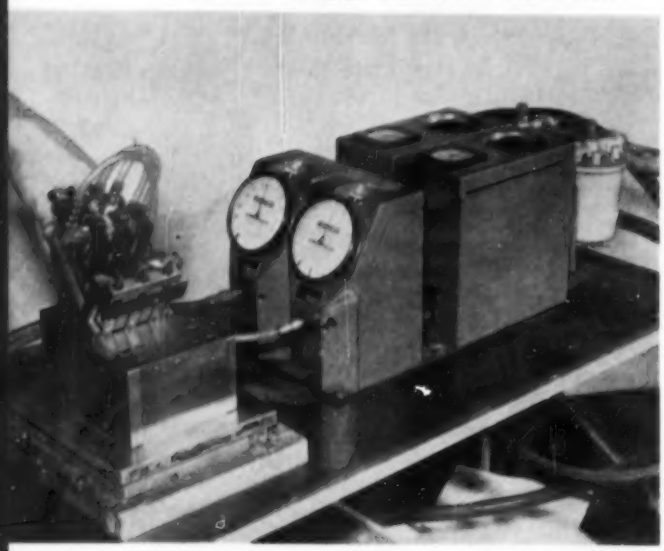
Inspection requirements were re-evaluated to determine if a multipurpose gage could be designed to reduce checking time and minimize human errors. Result of this study is an air gage, *Figs.* 1 and 2, with which a stator assembly can be gaged in one hour. The new gage is not only faster but it is more accurate. Different inspectors obtain the same total exit area measurement with this gage,

which was not necessarily true with the former gage.

The gaging member applied to the stator takes three width and one length measurements simultaneously as in the former method, but much more rapidly. Width measurements are automatically averaged and show on the air gage as one reading. A second Dimensionair unit indicates length. The width readings are weighted to compensate for their not being proportionate distances from the center of the wheel. (A newer gage of the same type is being developed with equally spaced measurements so weighting will be unnecessary.)

Application of the gaging member is rapid. Since it must be positioned accurately to measure the minimum widths of the exit area at the three points of inspection, the gage frame locates on the turbine wheel by means of two fixed reference contacts, *Fig.* 3, forced by spring pressure against the underside of the blade trailing edge. A pivoting reference stop on the gage frame locates against the blades' trailing edges to hold the frame in its proper angular position.

Fig. 4. Before the gagehead is used, it is placed in a master so the gage dials can be set to zero.



The actual gaging units are three, hinged calipers, each with an air probe to translate lever movement into air pressures. Calipers are attached to the gage frame by leaf springs to allow them to float independently. A special master, *Fig.* 4, is used to set the gage dial to zero.

With the gage pressed into position between blades by spring pressure, each caliper can be pivoted independently to find the minimum opening, as shown by the minimum reading on the air-gage dial. When this has been done for all three calipers, their three air probes contribute to the over-all reading and the air gage gives the average width reading for the exit area. Repeating width and length measurements for all openings then gives the total exit area of the turbine stator.

Most W.A.D. gages are not as complicated as the turbine-stator gage. A more typical example of gage selection was that for a rocker-arm bushing. With fixed-limit gaging, trouble developed and the bushing would not clean up during assembly. The cause was local, low spots in the bore that the plug gages could not detect. A dial indicator gage —capable of detecting local oversize conditions— was purchased to supplant the plug gage and assembly troubles stopped.

Upgrading of gaging methods, as in this instance, contribute to reducing scrap and rework throughout the plant. When engines are built to closer tolerances than those now specified, this movement to upgrade gaging methods will continue. In fact, gage upgrading will probably have to accelerate to keep abreast with the ever-increasing demand for higher production and decreased part tolerances.

Automation -- from Old Arabia

Wine is automatically poured by a "robot" serving girl in an Arabian version of automation. This invention of 1206, reported on an old Arabian plate as an "Ingenious geometrical device," is described as a wooden sentry box type structure a little over 5 ft high. Wine is poured into a copper dome on top which serves as a reservoir. Below the dome a container holds a reversible cup which receives the slowly dripping wine. About eight times an hour the cup is filled, tips over and empties its contents into the container. From there it runs through a tube into a glass drinking cup held in the hand of a figure created to look like a young serving girl. Right arm of the figure is movable on a pivot at the elbow. A backward extension arrangement from the forearm is so designed that it hooks to the wall of the house to hold the doll while the cup is being filled.

When the cup fills, it weights the arm, disengages the hook, and the figure, mounted on a rollered pedestal, slips forward, guided by grooves in a sloping base. The outstretched left hand of the figure pushes open hinged double doors. The doll rests at the threshold and offers the full cup to the person seated in front of the house. When finished the figure is pushed back into the house, the doors automatically close, the hook is automatically fastened, and the performance is repeated.

how to use tape controlled machining

By Murray Kanes
Head, Electromechanical Dept.
and
C. B. Sung
Manager, Mechanical Development
Bendix Aviation Corp.
Research Laboratories Div.
Detroit, Mich.

The bright promise of tape control has at last matured. This article by two outstanding authorities who participated in this development, affords tool engineers a practical view of what they will need to know to work with these new systems.

RECENT DEVELOPMENTS point to the fact that tape control of manufacturing processes soon will become widespread. Announcement has been made of completion of a large milling machine for a major aircraft firm, designed and built with a numerical control system as an integral feature, *Fig.* 1. Production experience has already proved the practical value of such an automatic machine tool system. Further, the system has shown its reliability under factory conditions. For instance, a tape-controlled three-dimensional cam machine, *Fig.* 2, has been in successful operation at an aircraft-accessory

manufacturing facility for some time. It has accumulated over 12,000 hours' use.

One of the first questions raised by a development such as this is where can it be used to greatest advantage. The trend to more automatic control could definitely be hindered by improper application from both economical and technical standpoints. It should be realized that certain types of machining operations are more economically suited for automatic control than others.

When applying automatic control to a certain type of machining operation, the choice of adapting an existing machine, extensively modifying or designing a new machine, again is dictated by economics. The need of automatic control may not always be obvious if attention is focused only on the machine tool in its existing form with automatic control merely an added improvement.

A more basic engineering approach, to visualize the benefits of automatic control, is to examine how certain parts can be produced better. An even more radical manner of evaluating potentialities of automatic control is to consider how machines and equipment can be designed and constructed to take the greatest advantage of this new manufacturing concept. In this way a fully integrated system can be achieved.

The Bendix development represents such an integrated manufacturing system. Its main elements are a computer for automatic processing of engineering and machining information, a machine tool designed for automatic operation from a punched plastic tape, electronic and hydraulic controls to translate the recorded machine instructions from the tape accurately and rapidly into drive motions of the machine slides and, finally, digital feedback instruments coupled to each machine slide to accurately measure the relationship between cutter and workpiece at each instant throughout the operating cycle, *Fig.* 3.

Fig. 1. (above) Contour milling machine, specially developed for The Martin Co., Baltimore, utilizes tape control as an integral element of the unit. Operator's console includes feed rate override control and precision positioning for manual setup.

Fig. 2. (right) Cam-milling machine, tape controlled, in use at Bendix South Bend plant producing three-dimensional cams.

Where To Apply Tape Control

Considering possible applications, the aircraft industry affords an immediate area for tape controlled machining, particularly in milling operations. The tremendous advances in military aircraft performance during the past few years have been accompanied by radical changes in manufacturing techniques. The advent of new materials, coupled with increased emphasis on weight reduction in the airframe, has replaced many sheet-metal assemblies by intricately sculptured machined parts. Furthermore, forged and cast fittings which formerly were partially machined are now finish machined to

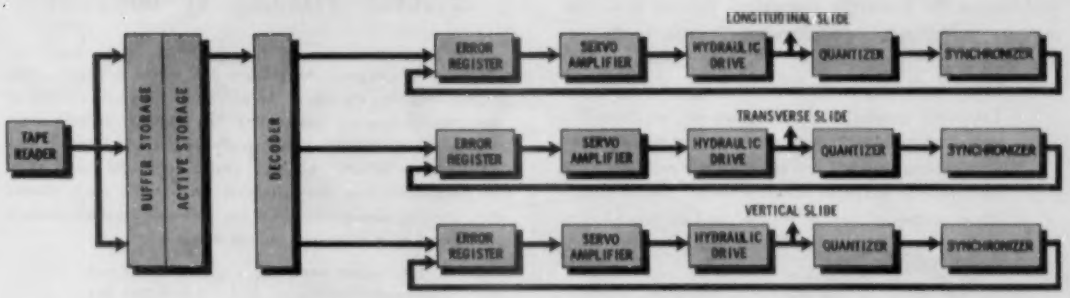


Fig. 3. Diagrammatic representation of machine control unit showing functional operation.

closer tolerances in order to eliminate the last ounce of dead weight.

The effects of this weight reduction effort are also imposed on manufacturers of jet engines and other accessory equipment which constitute the modern fighter, missile or bomber. In many cases, intricacies of the design of new parts limit a human operator's ability to control the machining operations' high scrap rate—this despite elaborate tooling and fixtures. Tape control of the machine tool offers a solution toward reducing the machining bottleneck as well as accelerating the reproduction tooling program.

The immediate application of tape control in the automotive industry appears to be in the making of tools and dies rather than parts. The prospect of reducing the high cost and long lead time involved in the many automotive body and forging dies which are required indicates extensive applications for tape-controlled die-sinking machines.

Many more applications for tape-controlled machine tools will evolve as the potential benefits become more widely understood and accepted. The dictating factor in each new application will be improvement over conventional processing with respect to one or more of the following considerations:

1. Ability to fabricate parts of complex design, previously not feasible
2. Reduced setup and/or machining time
3. Reduced tooling cost and lead time
4. Better finish or accuracy
5. Better repeatability
6. Increased versatility
7. Alleviation of skilled operator shortage.

A broad and important category of tape-control applications in industry, then, is for machine tools used mainly on short-run jobs. The simplification of tooling and reduction of setup time will ease the problem of change-over from one small-lot job to the next. In this case, as in the toolroom, where versatility has been the key factor in machine-tool utilization, tape control appears to hold extensive promise. This field of application may be thought of as the low-production type of automation, in contrast with the form of automation found in mass production, such as is seen in the automotive industry. By providing a means of meeting the challenge and competition of large-scale automation, tape-controlled machine tools ought to be a practical asset even in the smallest job shop.

Evaluating Applications

Technical concepts, equipment and even the terminology of tape control are foreign to most machine tool users. Consequently, evaluating applications and potentialities can be a confusing and frightening ordeal. A further deterrent to making the first plunge may be apprehension concerning organizational problems that might accompany the introduction of radically new equipment into the plant.

Experience with tape control, both in the laboratory and in three years of shop operation, shows that adoption of the system is much simpler than anticipated. In contrast to many predictions, no large staff of mathematicians or specialists is needed. The function of the tool engineer remains unchanged. He provides the basic manufacturing information in a numerical form suitable for machine control, in addition to designing tooling com-

patible to the system. His job becomes more important since complete manufacturing engineering replaces skills formerly furnished by the ma hine operator. Pertinent conclusions drawn from experience are:

1. Extensive re-education of equipment procurement, operating or management personnel is not required
2. Conventional criteria for machine-tool evaluation for procurement purposes are applicable
3. Plant personnel can as readily become conditioned to this equipment as with any other new machine in the shop
4. No personnel or organizational problems are created
5. Anticipated improvement in lead time and quality is realized
6. Down time for maintenance is comparable with other machines.

If the conventional criteria for evaluating plant facilities are basically sound as applied to procurement and utilization of ordinary machine tools, then the same principles should apply to tape controlled equipment. The evaluation will however have little significance unless the over-all tape-controlled manufacturing system is considered as an entity. A tape-controlled machine tool, to be a practical manufacturing asset, must be accompanied by a practical means of tape preparation. Since the tape-controlled system encompasses the elements for

Fig. 4. Tool engineer checks punching of control tape from duplicate data automatically registered by an electric typewriter. He can make changes or corrections in the computer (background) from keyboard of typewriter.

Process Planning by Computer

Use of a computer to prepare the machine control tape greatly simplifies the job of the process engineer. Conversion of the process-drawing coordinates to machine control units in binary code is done automatically by the computer. It also automatically offsets the tool center from the part edge. To understand how the computer programs a part, assume that, starting from a base point the following machine motions are desired of a three-axis milling machine:

Longitudinal motion	X = 0.1532 inch
Transverse motion	Z = 0.0862 inch
Vertical motion	Y = 0.0288 inch

Since the machine unit of movement is 0.0002 inch, the first step is converting the desired increments of motion to machine units.

X = 0.1532 ÷ 0.0002 = 766 units
Y = 0.0862 ÷ 0.0002 = 431 units
Z = 0.0288 ÷ 0.0002 = 144 units

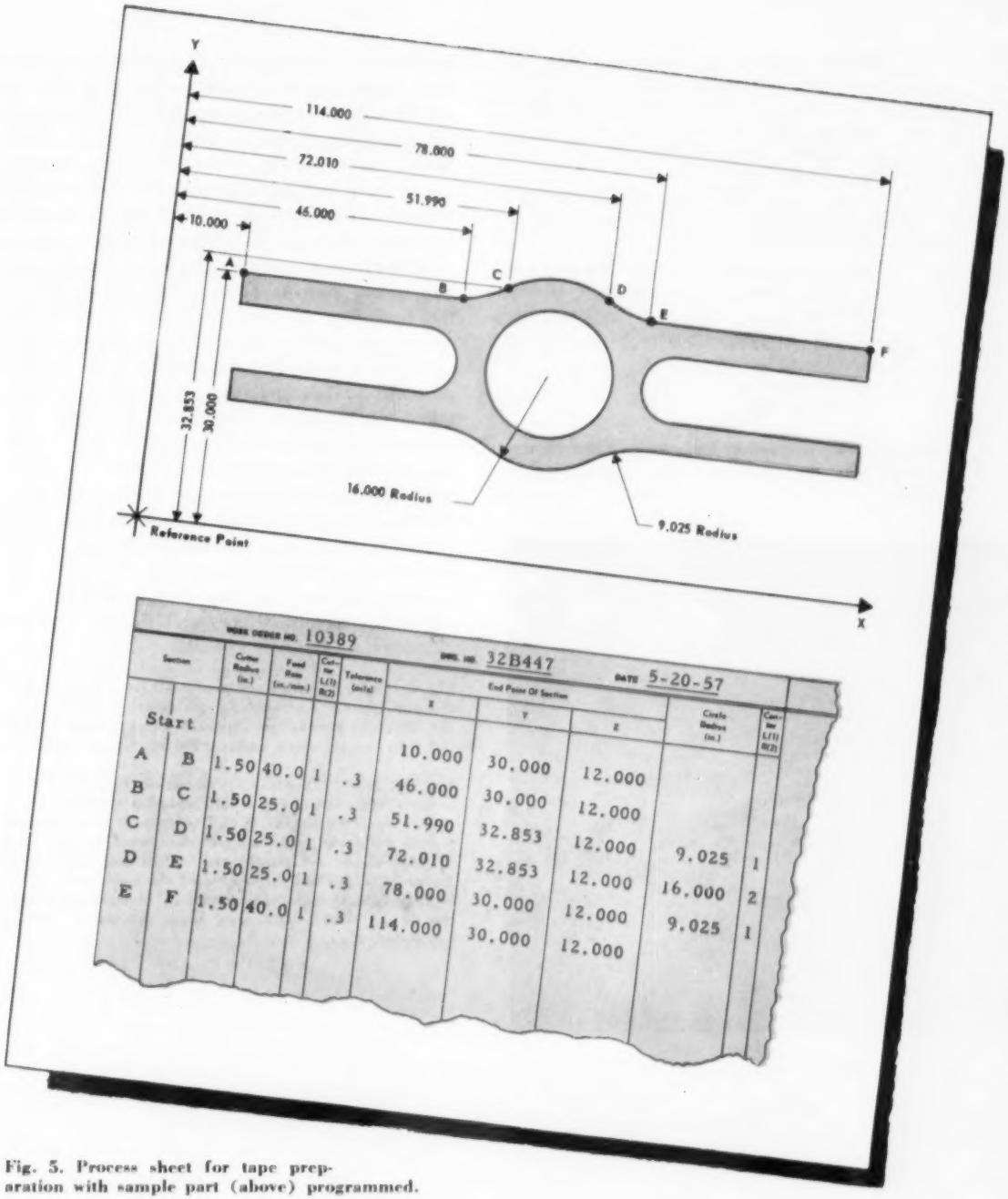
These increments are punched on the control tape in binary code, which simply represents decimal numbers by a series of ones and zeros.

X = 1011111110 binary number for 766 units
Y = 0110101111 binary number for 431 units
Z = 0010010000 binary number for 144 units

On the tape, a punched hole represents a one and no hole represents a zero. The computer method of forming binary equivalents is different from usual methods, however. The binary number is formed in reverse from the right—the correct order for punching on a tape. Successive division is used. The number is divided by two (the base for the binary system). This division results in a quotient (odd or even) and a remainder (1 or 0). The remainder is the right-hand digit of the binary number. The first quotient is divided by two to yield another quotient and remainder. This process is continued until there is neither a quotient nor a remainder. For the decimal number 766, the method is applied as follows:

766 ÷ 2 = 383, remainder 0 - no hole
383 ÷ 2 = 191, remainder 1 - hole
191 ÷ 2 = 95, remainder 1 - hole
95 ÷ 2 = 47, remainder 1 - hole
47 ÷ 2 = 23, remainder 1 - hole
23 ÷ 2 = 11, remainder 1 - hole
11 ÷ 2 = 5, remainder 1 - hole
5 ÷ 2 = 2, remainder 1 - hole
2 ÷ 2 = 1, remainder 0 - no hole
1 ÷ 2 = 0, remainder 1 - hole

The longest motion possible on the machine is 120 inches, 600,000 machine units. This dimension would require a 20-digit binary number and a sign to indicate direction. Since each hole or sign requires 0.1 inch of tape, this binary instruction would require 2.1 inches of tape.



WORK ORDER NO. 10389 DWG. NO. 32B447 DATE 5-20-57

Section		Cutter Radius (in.)	Feed Rate (in./min.)	Cutter L(1) R(2)	Tolerance (mils)	End Point Of Section X	Y	Z	Circle Radius (in.)	Cutter L(1) R(2)
Start						10.000	30.000	12.000		
A	B	1.50	40.0	1	.3	46.000	30.000	12.000		
B	C	1.50	25.0	1	.3	51.990	32.853	12.000	9.025	1
C	D	1.50	25.0	1	.3	72.010	32.853	12.000	16.000	2
D	E	1.50	25.0	1	.3	78.000	30.000	12.000	9.025	1
E	F	1.50	40.0	1	.3	114.000	30.000	12.000		

Fig. 5. Process sheet for tape preparation with sample part (above) programmed.

process engineering and manufacturing as well as for automatic control of the machine, the problem of evaluating tape-controlled systems is one of assessing the over-all manufacturing process in comparison with the conventional machine tool. The main economic criteria are the following:

A. Direct Factors
   1. Cost of the complete system
   2. Facility requirements: floor space for equipment installation and storage for tooling or tape
   3. Personnel requirements: number and skill of direct and indirect personnel for operation and related planning, inventory and clerical functions
   4. Productivity: floor-to-floor time per part
   5. Tooling or tape preparation cost: direct labor cost for making tooling or tape
   6. Quality: best accuracy and surface finish available.

B. Indirect Factors
   1. Versatility: adaptability to variety of jobs con-

sidering ease of setup, tooling complexity, capacity, and range of feeds and speeds

2. Repeatibility: variation of accuracy and surface finish from part to part
3. Predictability: consistency of machine time from part to part
4. Tooling or tape lead time: preproduction time lag for prototype part, and in case of design change
5. Acceptance: attitude of machine operator and supporting personnel as it influences efficient utilization
6. Reliability: down time required for maintenance
7. Performance limitation: degree of superiority of performance features which will insure against early obsolescence.

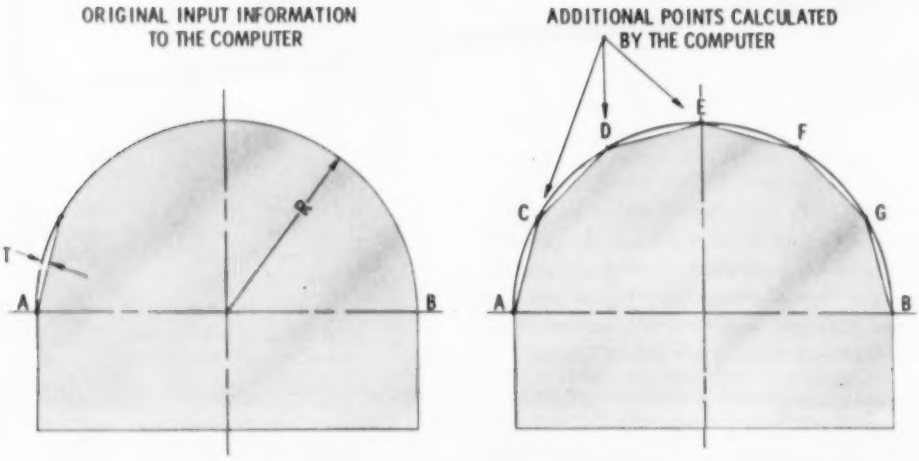
The previous discussion has stressed the importance of considering the tape-control application on an integrated-system basis. It is implied that each plant using tape-controlled machines is also required to have its own tape-preparation facility. In many of the larger plants, extensive computer facilities may already exist. In the small shop, however, where there has been no precedent for computer utilization, the introduction of tape-preparation equipment might be considered out of the question.

It is, of course, not essential that a tape-preparation system exist in the manufacturing operation; the feasibility of obtaining tapes from outside sources or, for that matter, from existing computer installations in another department in the plant is governed by considerations of compatibility with the control system used on the machine tool.

Digital computers, which are finding increasing use in industry for scientific and business application, are adaptable for preparation of control tapes. The function of a computer in evolving a numerical control tape is to generate sufficiently detailed tool path information, from the relatively few dimensions given on the blueprint, to produce continuous control of the machine. Fundamentally, computations

Fig. 6. (left) Preliminary process tape is prepared in clerical typing operation from process sheet. Verifier on right checks the tape. This paper tape is then fed into computer to make machine control tape.

Fig. 7. (below) Tooling information furnished computer (left), for circular cut includes coordinates of *A* and *B*, circle radius *R* and tolerance *T*. Additional points are then automatically computed to give path *ACDEFGB*, so all points are within tolerance from desired circle. Path the center of the tool must follow is also automatically computed. This data plus feed rate is punched into control tape, the output of the computer, *Figs.* 4 and 8.



entail determination of the cutter path based on specified cutter size, and piece-part dimensions, and interpolation of specified curves to yield a sufficient number of intermediate control points. Any general-purpose digital computer is capable of handling this type of numerical data processing to produce the required results in numerical form from input instructions also expressed in numerical form. The numerical output of the computer may be recorded directly in code form on punched cards or tape.

Programming Parts for Tape Control

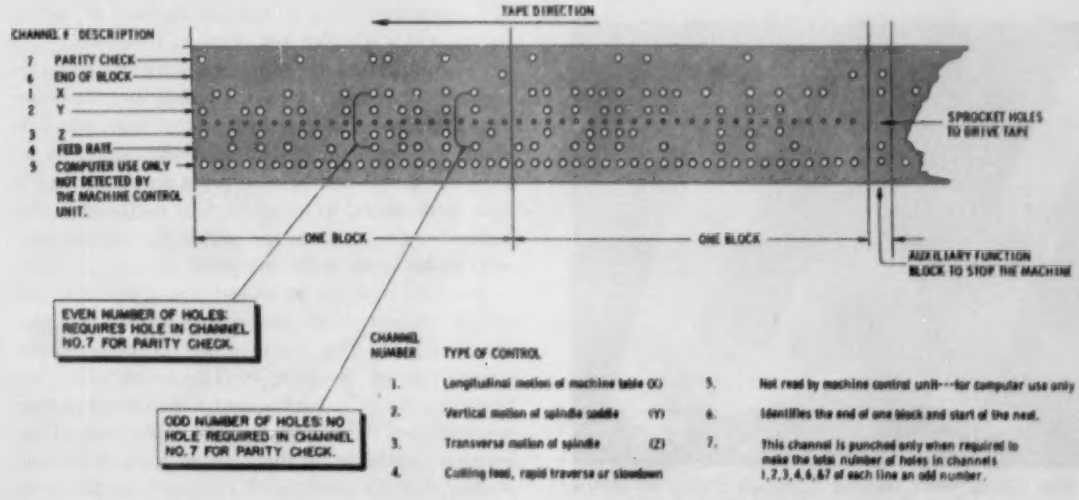
The Bendix tape-preparation method is automatic, utilizing functional programs specifically developed for the requirements of machine-tool application. The G-15D general-purpose computer is the heart of the tape-processing equipment, *Fig.* 4. In physical size, the computer is approximately equivalent to two standard 4-drawer filing cabinets. Division or multiplication operations are performed at the rate of 60 per second, while additions or subtractions require approximately ½ millisecond. Highly reliable operation is achieved by systematic preventive-maintenance measures.

Tape preparation starts with the process engineer who prepares a process data sheet, *Fig.* 5, containing key dimensions obtained from the part drawing, and machine-process information including cutter size and feed rate. A straight-line section on the part is defined on the process sheet by two lines designating the start and finish points respectively. In the case of a curved section such as a circular arc, the arc radius is specified in addition to the start and finish points. Provision is also made on the process sheet for designating the tolerance required on curves.

The completed process sheet is next copied by means of a clerical typing operation using a Flexowriter, *Fig.* 6. The Flexowriter simultaneously produces a typewritten copy of the process sheet and a punched-paper tape which contains the processing information in a form acceptable to the computer. The process tape is read by the computer which automatically produces the control tape in the form required for machine control.

Functions of the computer include determination of cutter-center offset, interpolations of curved sections to provide intermediate points defining a continuous cutter path, resolution of specified feed rate into required speeds of the individual machine slide, translation of decimal input information into binary coded form, and generation of checking information. The interpolation function performed by the computer establishes the required spacing of intermediate points on curved sections in accordance with the tolerance specified on the process sheet. Since the cutter path between succeeding points on the control tape will be along a straight line, *Fig.* 7, the spacing of points will vary continuously so that the deviation from the desired curve will always be sufficiently small to satisfy tolerance or finish re-

Fig. 8. Laminated plastic-aluminum tape is punched in seven channels as shown. Each block of binary coded instructions commands a straight-line motion of the tool relative to the workpiece.


TAPE DIRECTION
CHANNEL # DESCRIPTION
7 PARITY CHECK
6 END OF BLOCK
1 X
2 Y
3 Z
4 FEED RATE
5 COMPUTER USE ONLY NOT DETECTED BY THE MACHINE CONTROL UNIT.
SPROCKET HOLES TO DRIVE TAPE
ONE BLOCK
ONE BLOCK
AUXILIARY FUNCTION BLOCK TO STOP THE MACHINE
EVEN NUMBER OF HOLES: REQUIRES HOLE IN CHANNEL NO. 7 FOR PARITY CHECK.
ODD NUMBER OF HOLES: NO HOLE REQUIRED IN CHANNEL NO. 7 FOR PARITY CHECK.
CHANNEL NUMBER
TYPE OF CONTROL
1. Longitudinal motion of machine table (X)
2. Vertical motion of spindle saddle (Y)
3. Transverse motion of spindle (Z)
4. Cutting feed, rapid traverse or slowdown
5. Not read by machine control unit—for computer use only
6. Identifies the end of one block and start of the next.
7. This channel is punched only when required to make the total number of holes in channels 1,2,3,4,5,6,7 of each line an odd number.

quirements of the particular workpiece.

The method is versatile so that numerous subroutines can be employed. Completely general two and three-dimensional programs, for example, include the ability to handle any analytically defined curves, as well as automatic pocket-milling and profile-roughing operations. Consequently, the need for tedious hand computation by the process engineer is eliminated. A tooling or process engineer can be trained to use this system in less than one week.

A punched plastic tape, *Fig.* 8, containing binary coded instructions, as produced by the computer, is used as the input to the machine control unit, *Fig.* 9. The punched control tape is a compact recording of the coordinated movements of the machine slides required to maintain the changing relationship between the cutter and the workpiece. In addition, the tape contains instructions for cutter feed rate, auxiliary control functions, and checking information. The latter is used in reading tape photoelectrically, giving a parity check of each line on the tape to insure against typographical or reading errors. The binary instructions for each controlled motion are converted into a train of electrical pulses, each representing a command for the machine slide to move a specific distance. A pulse value of 0.0002 inch is usually employed, although this value can be smaller if desired. Each machine motion is provided with a rotary digital feedback instrument that measures the actual movement in increments of 0.0002 inch. The accumulated difference between command and feedback pulses is converted to an analog signal which is fed to the hydraulic servo drive unit. A high-performance two-stage servo valve with 90-deg phase shift in excess of 250 cps was developed specifically for machine tool application. This unit, coupled with a rotary hydraulic motor, provides extremely fast and accurate response of the machine to input electrical commands. Consequently, the machining operation can be controlled to produce much higher speeds and accuracies of metal removal than is possible in a conventional hand-operated machine.

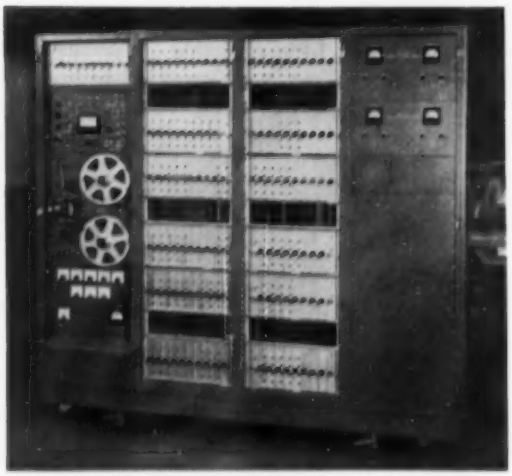


Fig. 9. Electronic machine control unit showing plug-in packages used for rapid maintenance. Checking and monitoring controls are above photoelectric tape reader. Symmetry controls will produce right-hand parts from left-hand tape.

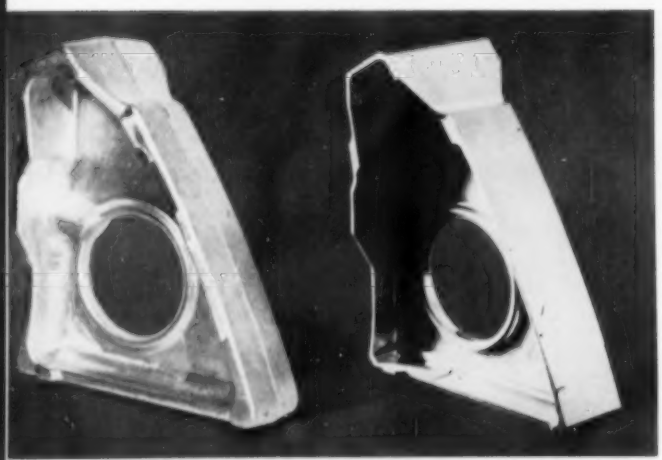
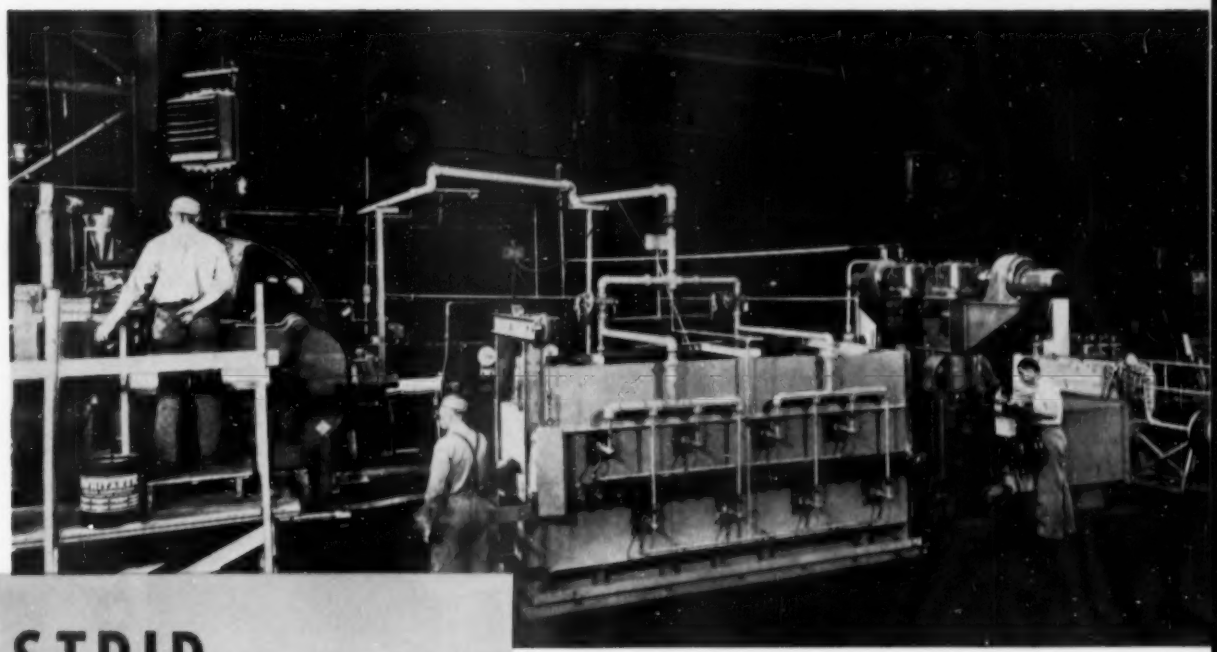


Fig. 10. Aircraft forging in rough (left) machined in tape-controlled mill, including boring of center hole (right). Surface finish and cutter life are better than in conventional setup.

A production application of this system can be best illustrated by an actual example. A representative part, shown in *Fig.* 10, is a rough forging which is to be finish machined on the outside and inside profiles; the large central hole is to be accurately bored, and a forged boss removed on each face. The tooling program for conventional processing using a tracer-controlled machine tool involves a total of 210 hours. Included is the time for design and manufacture of a holding fixture, a boring fixture and a complex set of tracer templates.

For comparison, the tape-control tooling program requires 92 hours. The boring fixture and templates are eliminated. The punched control tape, which is about 100 feet long, is automatically prepared by the computer in one hour. Process data preparation time is 16 hours, followed by four hours of Flexowriter time to produce and verify the process tape used as the input to the computer.

The total time for setup and run of the tape-controlled machine on the first part is 2 hours, whereas the equivalent time required on the conventional tracer-operated machine is 5½ hours. The impressive savings in tooling and manufacturing time is considered to be a conservative indication of the benefits obtainable for this class of work. It is noteworthy that the part finish produced on the tape-controlled machine is considerably better than that which is obtained conventionally.



STRIP produced from POWDER METAL

Strip mill reclaims scrap by rolling strip stock directly from powder metal without the conventional intermediate steps.

As EXPENSIVE METALS and alloys play a larger role in metal fabrication, scrap reclamation becomes increasingly important. A promising development is a new process which converts scrap metals into finished sheet without the usual casting of billets and successive rolling operations.

First step in the process is a direct chemical conversion of the metal into powder form. This powder is then converted into strip by a special rolling mill developed by the rolling mill division of E. W. Bliss Co. On the experimental line, shown in operation at the firm's Salem plant, six-inch-wide stock is produced in continuous strip form.

In the process the powder metal is dumped into the hopper shown at extreme left. It then feeds into compacting rolls to develop sufficient green strength to carry it through a sintering furnace (center). From the furnace, it goes through the hot mill rolls and emerges as finished strip stock. This strip winds on the coiler shown at the extreme right.

The method is streamlined, since the powder metal is fabricated directly without the intermediate steps of melting, casting into ingots, annealing and rolling through several mills to secure the desired thickness. Direct labor savings over conventional rolling methods are estimated to be 80 percent. Applicable to a wide range of metals, the process can be used for ferrous alloys, copper, nickel titanium and other metals. Finished strip compares favorably with the physical properties of fine strip rolled by conventional multicycle rolling techniques.

While this development is based on established rolling principles, it represents a departure from ordinary concepts of metalworking. Chemetals Corp. holds the American rights to the German-originated chemical method of producing copper powder economically, and fabricating it into strip. Bliss, however, plans on introducing it to industry by designing and building the special equipment needed to process the powder into strip and tubing.

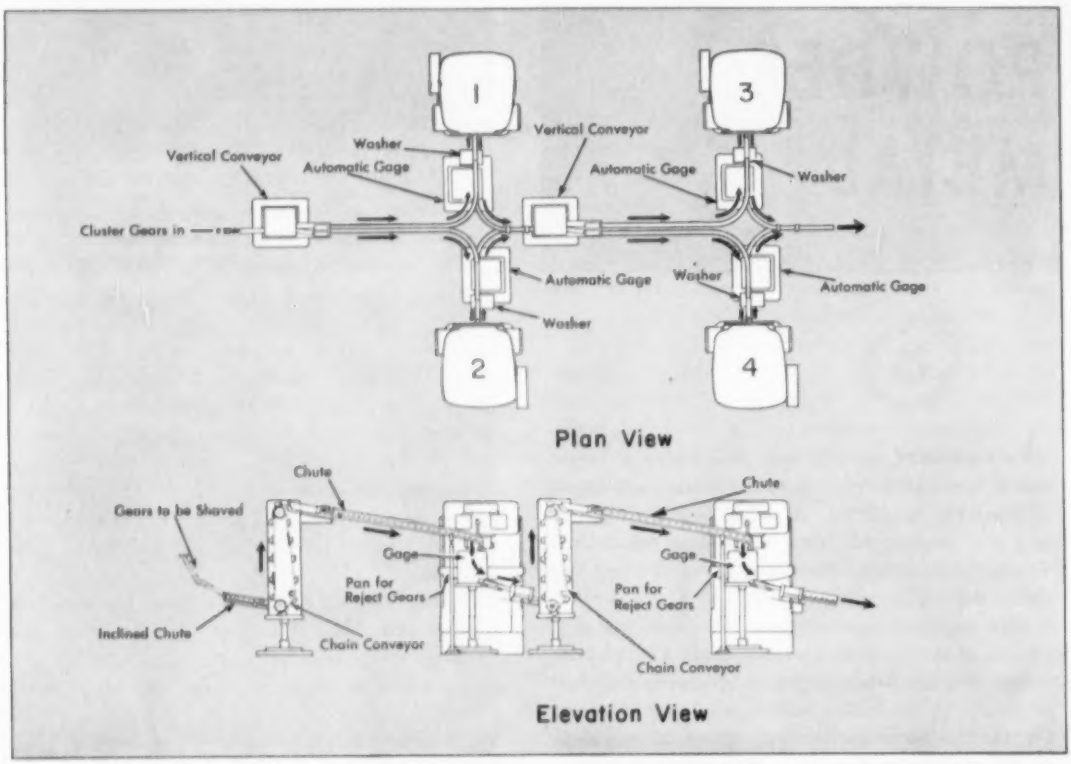
designed for

PRODUCTION

GEAR SHAVERS INTEGRATED
for automatic operation

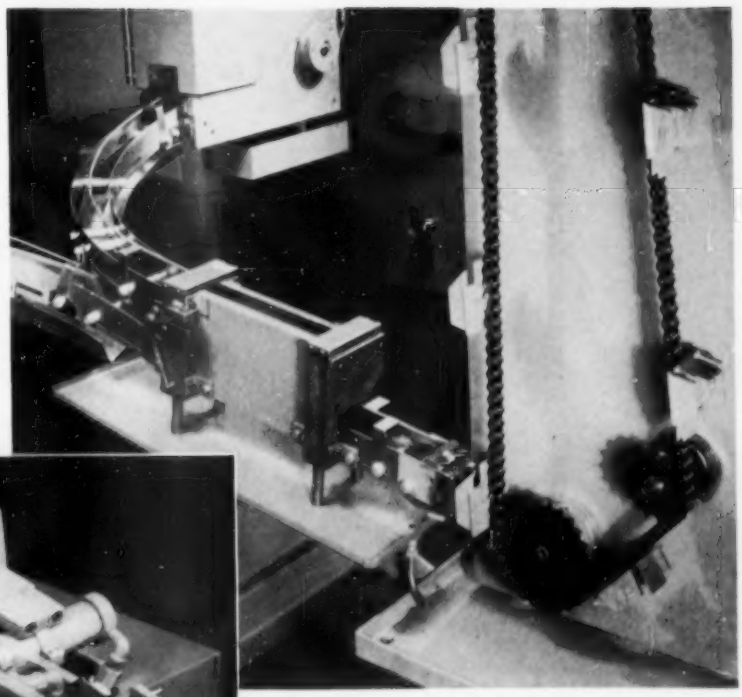
By integrating the feed and control functions of four gear shavers, two-gear clusters can be shaved and inspected automatically. If a cluster with three gears must be processed subsequently, another pair of shavers and associated accessories can be added to the system. Through use of diverters and "teeter-totter" mechanisms, gears can be fed to the machines that have available time.

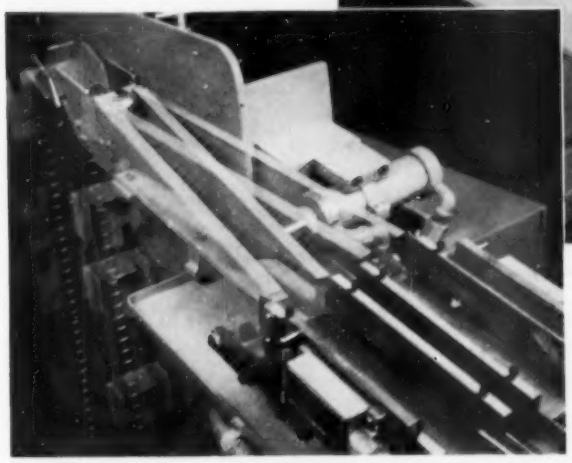
In this system, developed by the National Broach & Machine Co. from their standard units, automatic gages can be set to shut down individual machines after a predetermined number of rejects. The feed chute for that machine would fill up and feed would be diverted to the other machine. Since gears are returned to a common feed after each shaving operation, any cluster can be finished by any combination of machines, and the system can operate during tool changes and maintenance.



SHAVER DEPARTMENT can handle a variety of cluster gears using four standard rotary gear shavers. Each shaver has an automatic loader, and the four machines are tied together with curved, inclined feed chutes and vertical chain conveyors. Machines 1 and 2 shave the first gear, and machines 3 and 4 shave the second on a two-gear cluster. Pairs of shavers can be added if clusters have more gears.

FINISH-SHAVED gears are fed through washers and automatic gear checkers, where incorrect gears are dropped into reject pans. Gears that pass inspection are turned end-for-end by the curved chutes between pairs of machines and are lowered to a common chute by this anti-nicking teeter-totter mechanism. The mechanism comprises a spring-loaded flexible metal member mounted as a tilting cantilever. The weight of a gear tips the member and the gear is gently lowered to the lower, common chute.



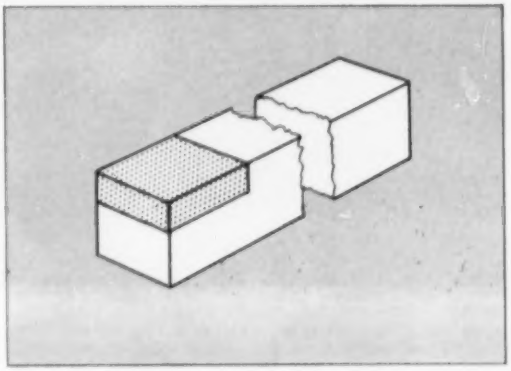


CLUSTER GEARS are received in a chute from the tooth-forming operation and are raised by a bucket on the chain conveyor. From this conveyor, they roll through the pictured short, pivoted chute. This diverter chute is operated by an air cylinder to direct gears into the automatic loader of either of the first pair of shaving machines.

SPECIAL ALLOY TIP
Triples Life of Bending Tool

Although the wire used for vacuum-tube filaments is fine, it is stable and causes considerable wear on bending tools. This wear is similar to that found in a drawing die. Tools tipped with tungsten carbide had to be replaced every 10 days.

To improve service life, tool engineers at Nihon Radio, Japan, applied a 1/8-inch-thick coating of WCR-100 alloy welding rod to the tip of the tool. This Wall Colmonoy alloy is an iron-base chromium-tungsten-boron material. Used in place of the tungsten-carbide tip, this material tripled the service life of the bending tool.

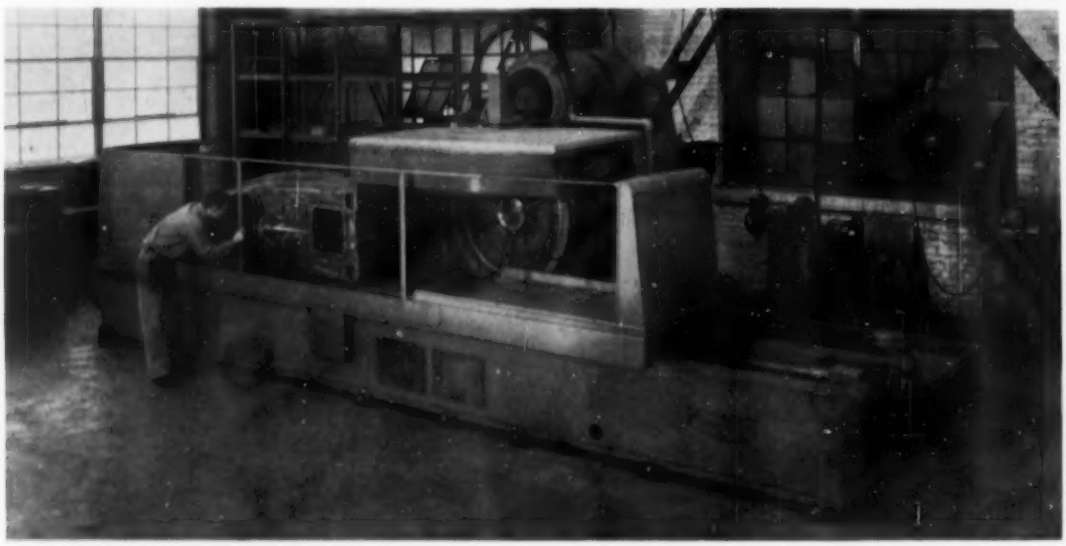


Large Grinder Tackles Big Jobs

SPINDLE MOTOR is rated at 150 hp and can stand 100 percent overloads for brief periods. This job indicates simplicity of one-step machining of rough castings made possible by high horsepower. Wheel can get under scale and remove large amounts of stock in a single pass. Also, hard spots have little effect on modern grinding wheels.

Giant grinding machines can effectively break through mental barriers as to what jobs—regarding size and stock-removal requirements—can be economically handled by grinders. Higher horsepower, sturdier machines and better grinding-wheel bonds have led to increased production at lower unit costs for the grinding process.

This grinder, developed by Mattison Machine Works, uses either horizontal or vertical magnetic chucks to simplify workpiece location and clamping. Machine-tool selection is also affected because interrupted cuts are an aid to grinding wheel efficiency. Interruptions help break and clear chips, and increase unit pressures by reducing contact area. This helps keep the wheel open and free cutting even on heavy cuts.



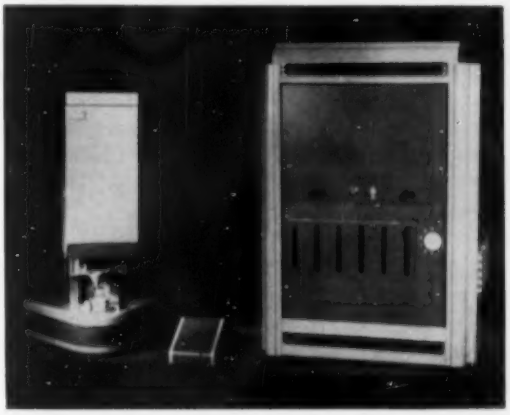
VERTICAL COLUMN for grinding machine is ground from the rough on large grinder. The column was slightly redesigned so full advantage of grinding could be realized. Cuts up to ¼ inch deep are taken on the high spots. Segmented wheel is used on this machine because of its faster cutting characteristics and because it offers the possibility for close control. Coolant can be used when needed.

Industrial Instrument Checks Dimensions against wave length of light

Applicable for checking and calibrating gage blocks, plug gages, balls and other secondary standards, this interferometer gaging-system can also be used on critical production parts having dimensions within the limits of head movement.

In effect, this instrument is two interferometers in parallel using the same optical system. Part of the beam splitter is covered with an oxide coating, which retards the light passing through. This has the effect of a 90-deg phase shift, which permits dividing a half fringe into smaller increments and indicates to the counter whether it should be counting up or down.

This basic scheme, developed by Link Aviation, Inc., can be applied to automatic measuring and sorting machines for checking parts, cams and contours. Two such interferometers could be combined for accurate positioning of tools or workpieces by X and Y coordinates.



FRINGE-COUNTING micrometer is an interferometer combined with an electronic, digital counter. It is only necessary to read the fringe count and multiply it by 11.5569 x 10^{-6} to obtain a dimension in inches. No secondary standards are needed.

TWO CONTROLS operate this interferometer; one moves the measuring head up or down; the other sets the counter to zero before a reading is made. To make a measurement, the head is driven down to the anvil, the counter is set to zero, the head is raised and then driven down onto the part.

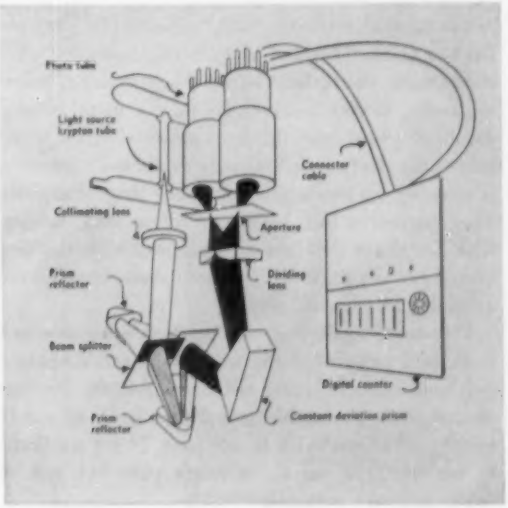


DIAGRAM of interferometer components illustrates light-splitting technique. A light beam is divided by partial transmission and reflection, sent on different paths and recombined. Depending on relative lengths of paths, the separate beams may reinforce or oppose each other to produce light or dark interference patterns. The lower prism reflector is directly attached to and moves with the measuring spindle.

electrolytic grinding

tames hard metals

By Lynn A. Williams
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TUNGSTEN CARBIDE, high-speed steel and special alloys have at least one thing in common. They are hard to grind. They are fairly docile, however, when subjected to electrolytic attack. Electrolytic grinding —passing electric current between a metal-bonded diamond wheel and the workpiece so stock is removed by electrolytic rather than abrasive action— is opening up new applications for these materials. Tool engineers can use them where they belong, with the shape they should have and with the necessary surface finish. These results can be achieved quickly and economically.

Electrolytic grinding can be done with as much work area exposed to the wheel as possible because overheating and glazing are not problems. Because of this, it is preferable to set the depth of cut to remove all excess stock in one pass. There are limits to the depth of cut for a single pass but cuts of 0.060 inch are common.

With such depths of cut, the table of the grinder moves more slowly than for conventional grinding cuts. A rough estimate of table speed, for electrolytically grinding cemented carbides, can be made by allowing one second for each inch of travel for each 0.001 inch of depth. Thus, a 1-inch-long cut, 0.010 inch deep, would be made in 10 seconds, requiring a table speed of about 6 ipm.

Since it is desirable to maximize contact area, passes are taken with the full width of the wheel, allowing only slight overlap between passes. The widest wheel practical for a particular job is used. In a typical case, a $\frac{1}{16}$-inch cut is made with a $\frac{3}{4}$-inch-wide wheel, across a cemented carbide bar, at a rate of 6 ipm. With these conditions, stock is removed at a rate of 0.28 cubic inches per minute. Removal rates can be doubled or tripled by using

Fig. 1. Parts with large voids, such as this differential component, are electrolytically ground without wasted time. The normally slow table feed is increased during nongrinding portions of the cycle.

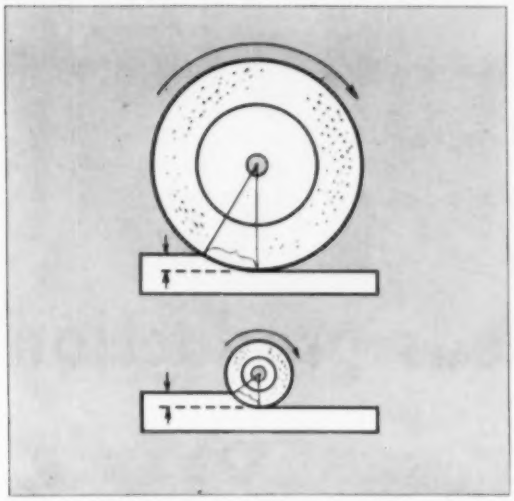

Fig. 3. With larger grinding wheels, there is greater area of contact, and material removal rates are higher.

wheels two or three times as wide, if the workpiece is big enough.

Because the nominal table speed is slow, odd shapes and pieces with large cavities, *Fig.* 1, can be ground without high percentages of "air grinding" time. It is possible to speed up the table feed so voids can be traversed quickly. Table speed is reduced just prior to re-entry of the wheel into solid material.

Electrolytic cylindrical and inside-diameter grinding are accomplished with slow workpiece rotation and full depth cuts. In cam grinding, similar procedures are particularly advantageous because even severe cam profiles can be generated without problems. Heavy cuts reduce grinding time, and slow speeds permit accurate following of the master. Where high accuracy is required, a second cut, 0.001 inch deep, can be taken with a higher rotational speed of the workpiece. Cams can thus be ground accurately with little wasted time.

Large contact areas are used in electrolytic grinding because material is removed primarily by electrolytic rather than abrasive action. The amount of material that can be removed in a given time is directly proportional to the amperage. The amount of current that can flow between the wheel and the work at a given ameprage is limited by the area of contact between the two. Contact area can be increased through the use of wide and large-diameter wheels, *Fig.* 2. The quantitative effect of wheel diameter on contact length can be clearly seen in *Fig.* 3.

By doing almost the opposite of what is done in conventional grinding, within limits, electrolytic grinding results can be highly efficient. A large amount of material can be removed in a short time.

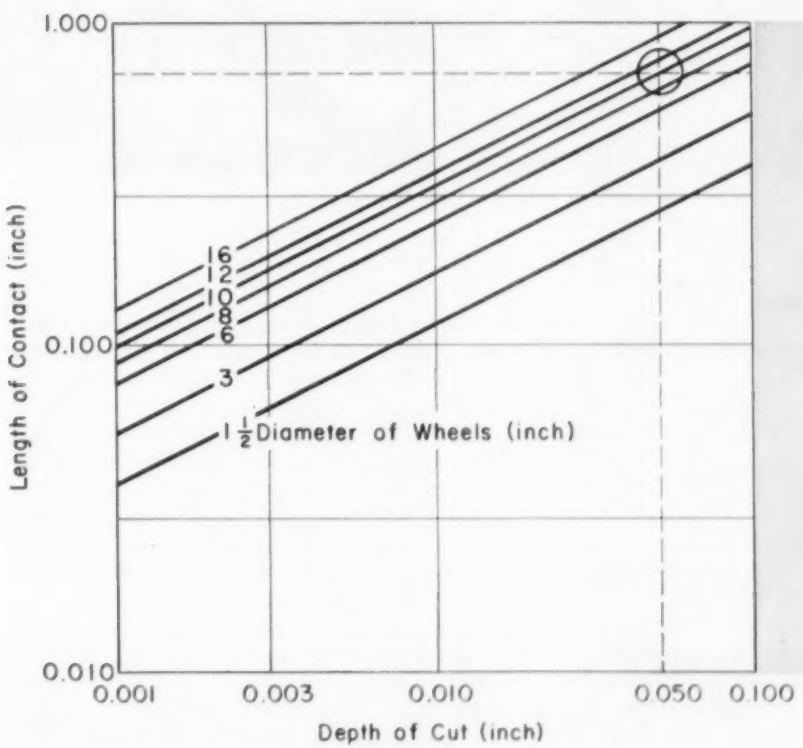

Fig. 3. Chart of wheel size showing varying lengths of contact for different wheels and depths of cut. As shown by dashed lines, length of contact is 0.7 inch for a 10-inch wheel operating at 0.050-inch depth of cut.

VACUUM CHUCKING speeds production

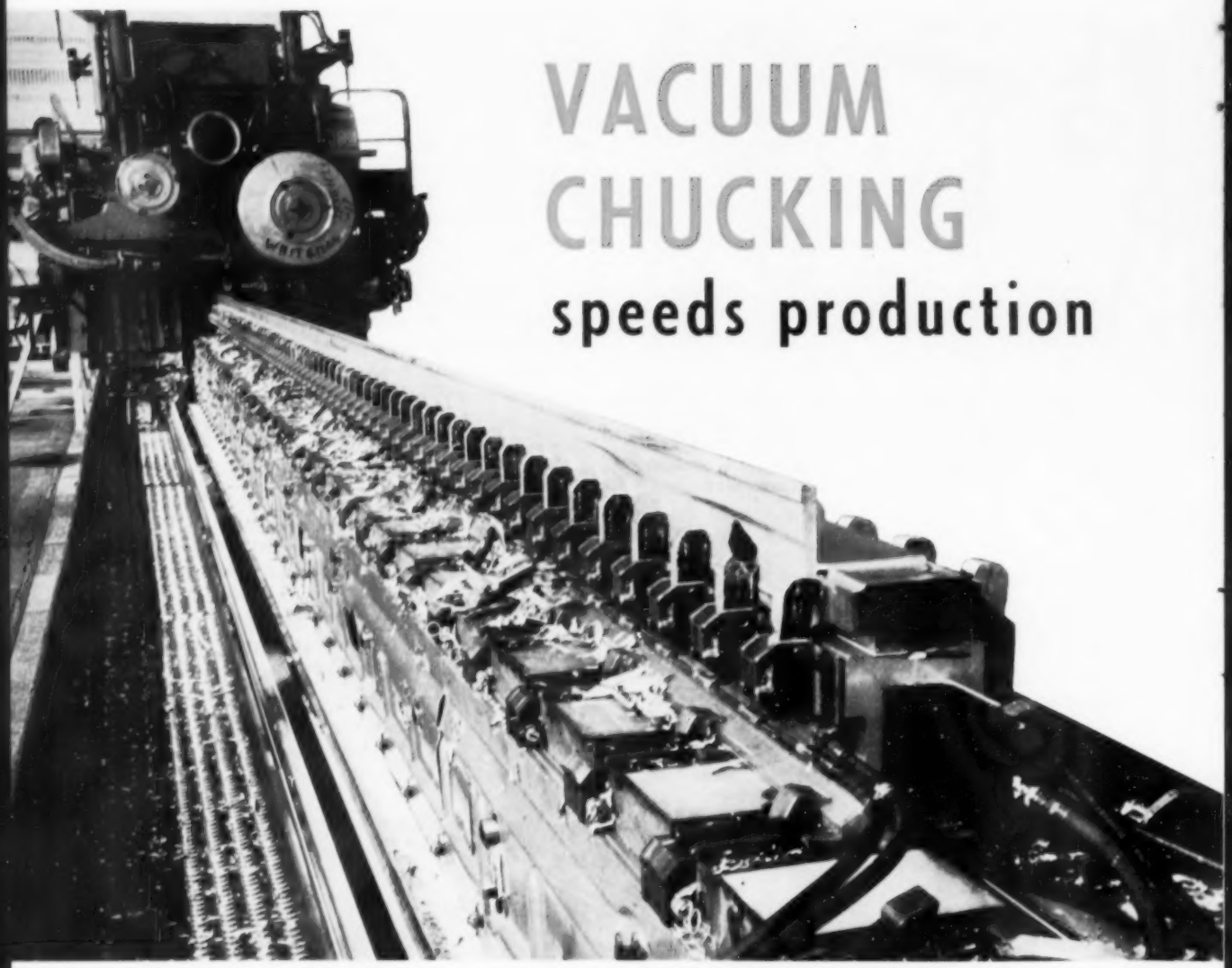

Fig. 1. Milling a DC-8 spar cap on a Farnham long mill. Vacuum chuck holds workpiece firmly in position.

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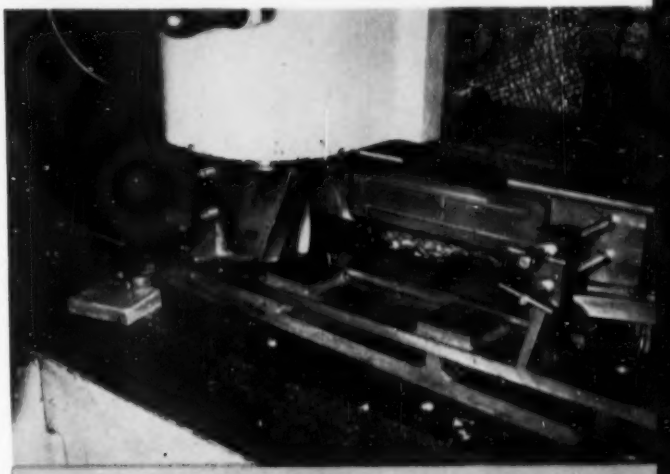
CLAMPING THIN AIRCRAFT parts for skin or spar milling operations has always been something of a problem. When mechanical or hydraulic clamps are used, clamping pressures are usually applied at intervals along the workpiece. There is a tendency for the portions of the workpiece not in direct contact with the clamps to vibrate, causing chatter marks and other surface irregularities. Furthermore, it is difficult to provide adequate mechanical clamping of odd-shaped workpieces.

Production experience at Douglas Aircraft has demonstrated that vacuum holding fixtures or chucks, *Fig* 1, eliminate many of the difficulties associated with conventional clamping methods.

*Senior member ASTE Los Angeles chapter.

Fig. 2. (left) The complete bed of this Giddings & Lewis skin mill is a vacuum chuck. Operators are fastening the four units of the chuck in place.

Fig. 3. (below) Unique vacuum chuck that holds workpiece vertically and horizontally.



Since workpieces are held by vacuum over their entire length, vibration during machining is virtually eliminated. In one instance, 0.040-inch thick stock, held by vacuum, is being milled to a thickness of 0.020 inch, with a 32-microinch finish.

Vacuum chucks were first used on a Giddings & Lewis skin mill at the El Segundo Division. Since that time, they have been successfully applied to spar cap milling, profiling and other machining operations at the El Segundo and Long Beach Divisions.

At the El Segundo Division, all vacuum chucks are fabricated from rolled aluminum bar stock or low-porosity cast-aluminum plate. All chucks are of the same basic design, made in a range of sizes to suit specific operations. The largest chuck is permanently mounted on the G & L skin mill, which has a bed area of 10 by 40 feet, *Fig.* 2.

Vacuum chucks used on a spar cap mill are approximately 30 inches in length and are detachable. Several smaller detachable units are utilized for other milling machines, *Fig.* 3.

The skin-mill vacuum unit consists of four cast-aluminum plates, each containing nine vacuum supply fittings. These fittings are screwed onto vacuum pipes in the machine base. To insure leak-proof operation, the fittings are bonded to the fixture with Cerrotru, a plastic material. The area which contacts the workpiece is machined smooth. This matching operation was accomplished after the fixture was mounted in the skin mill, using a light finishing cut.

Spiral grooves in the face of the fixture distribute the vacuum. These grooves, which are 0.001-inch deep, were also cut with the fixture in place on the mill by rapidly traversing the fixture under a slowly rotating single-point cutter.

To provide a vacuum seal, grooves are cut in the fixture plates to conform to the contours of the workpiece. The grooves accommodate rubber tubing which has a diameter sufficiently large so that a portion of the tubing extends above the surface of the fixture, *Fig.* 4. Weight of a workpiece on the

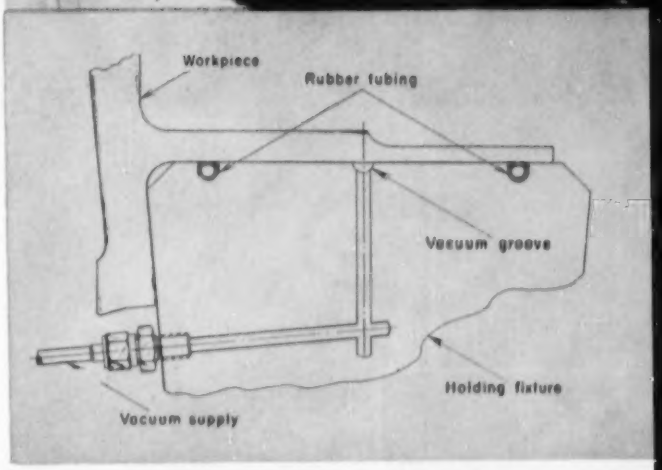


Fig. 4. Cross sectional view of vacuum chuck. Rubber tubing in outside vacuum grooves is depressed by weight of workpiece. This method used in the Torrance installations.

fixture is sufficient to deform the tubing, thus forming a seal.

Air is evacuated by a high-capacity vacuum pump. A large vacuum tank, *Fig.* 5, imparts an initial surge; thus, even workpieces which are too light to depress the rubber tubing can be successfully held. Design of the vacuum chuck for spar caps, *Fig.* 6, is similar to that of the skin mill vacuum chuck.

At the Long Beach Division, a vacuum chuck equipped spar mill is used for milling skin panels as long as 28 feet, with tapered thicknesses ranging from ½ to ⅜ inch. Other skin panels are milled as thin as 0.020 inch.

The Long Beach spar mill fixtures are made up

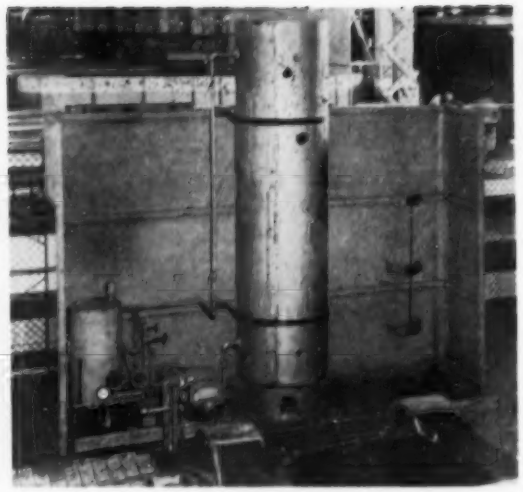


Fig. 5. Pressure supply unit for the G & L skin mill. At right is the tall surge tank.

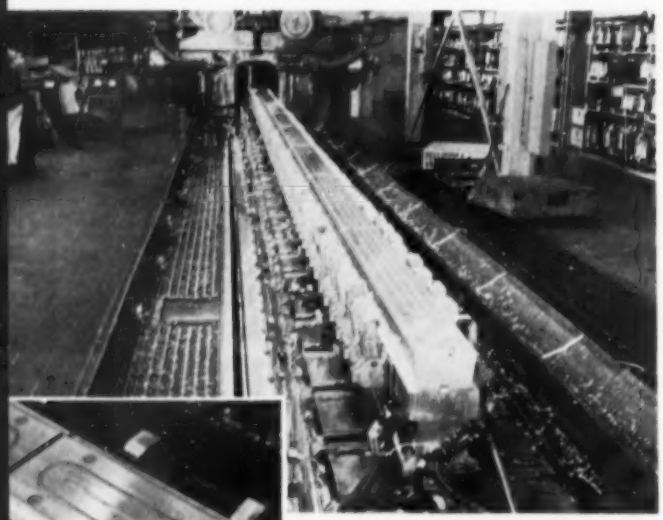


Fig. 6. (above) Vacuum holding fixture with workpiece removed. (inset) Close-up of chuck showing vacuum grooves.

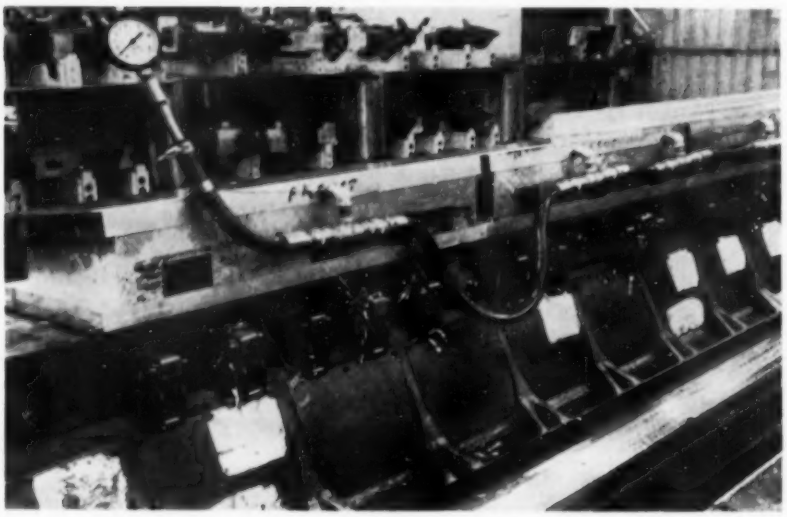


Fig. 7. (right) Close-up of spar cap on spar mill at Long Beach. Workpiece is shown in position at right.

of aluminum blocks, each 30 inches long. These blocks are mounted end-to-end on the work holder, *Fig.* 7. Each block is a separate vacuum unit, and is connected to the next block by a short length of flexible tubing which acts as a vacuum line. Micrometer slots between the blocks facilitate workpiece measurements. A vacuum seal around the workpiece is provided by a resilient neoprene compound, rather than by rubber tubing. In most other respects, design of this vacuum chuck is much the same as that of the El Segundo installation.

On all vacuum chucks for spar cap machining operations, supplemental hydraulic clamps are provided. The hydraulic clamping cylinders are integral with the spar cap mill holders and mechanically position the workpiece against locating stops. These clamps hold the workpiece securely during machining eliminating potential hazards associated with failure of the vacuum system.

Continued production experience with vacuum-holding fixtures has shown that tooling costs are reduced, since it is possible to utilize the same chuck for several different-sized workpieces. Setup time is also reduced because the vacuum holders do not require as much adjustment as mechanical clamps.

In some cases, machining time is reduced as well. In the design of workpieces, which will be mechanically clamped, it is often necessary to provide extra metal thickness for critical clamping areas. This excess metal must be machined off in an additional operation. With vacuum holders, there is no need for extra thickness at clamping areas; hence, extra machining operations are not required.

Another advantage of vacuum holders is that it is possible to readily machine odd-shaped parts on a production basis. Mechanical clamping of these parts would be complicated and costly. These advantages, coupled with improved surface finishes, make vacuum chucks a worthwhile investment.

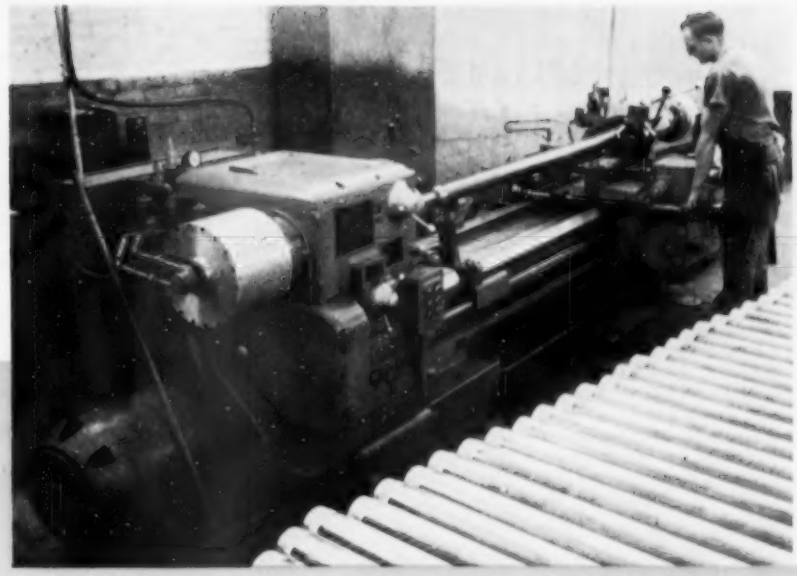


Fig. 1. Completed machine is used at Clark to machine and thread the ends of three types of hydraulic cylinders used in fork-lift trucks.

Hydraulic Cylinder Production

increased with unusual tooling

By C. V. Joecken

Tool Engineer
Cri-Dan Div.
The Lees-Bradner Co.
Cleveland, Ohio

Gripping tubes internally and machining portions of their internal surfaces represents a neat tool engineering trick. The author outlines the need for this technique and describes the equipment.

MAKING HYDRAULIC CYLINDERS is an exacting business but when the number needed jumps suddenly, production methods have to be reviewed. The Clark Equipment Co. found itself in this position when demand for fork-lift trucks spurted. Problems were bigger because three basic cylinder types are made. Some of these cylinders have male threads, some have female threads and still others have both.

Cylinders are made of seamless-steel tubing, roughly cut to length and finish honed on the inside. They vary in length from 8 inches to 10 feet, and in bore from 2 to 4 inches.

Because outside surfaces are irregular and out-of-round, it is necessary to hold, drive and support the tubes on the honed bores. This is the only way to be sure that the machined and threaded ends will be concentric with the bores.

Internal holding is not a difficult requirement for cylinders that have to be machined on the outside. It is a problem, however, for those that must be machined on the inside. In addition to preventing damage to finish-honed bores, any machine designed to finish all of these types of cylinders would have to provide room for tools to work inside the tubes. These requirements were the starting point for design of special tooling for a standard Cri-Dan "E" machine, *Fig.* 1, that would increase hydraulic cylinder production.

Because room would be restricted, it was decided

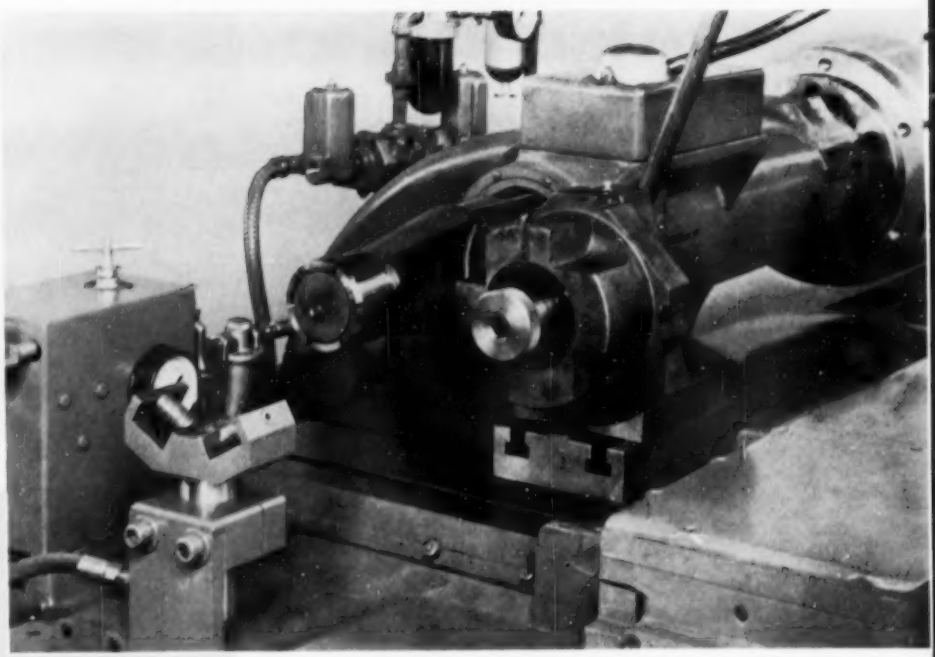
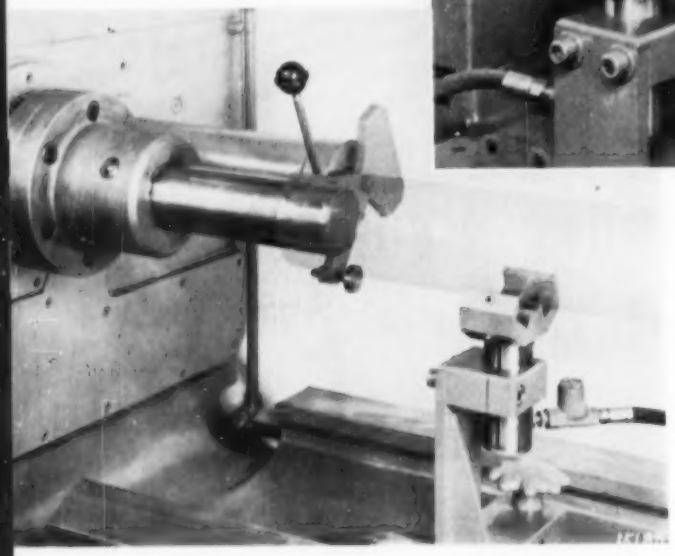


Fig. 2. All machining is done at the tailstock end of the machine. The recess behind the mandrel provides room for internal tools.

Fig. 3. Work spindle extends into and withdraws from the honed cylinder bore to aid loading. The mandrel can expand only when the spindle is extended.



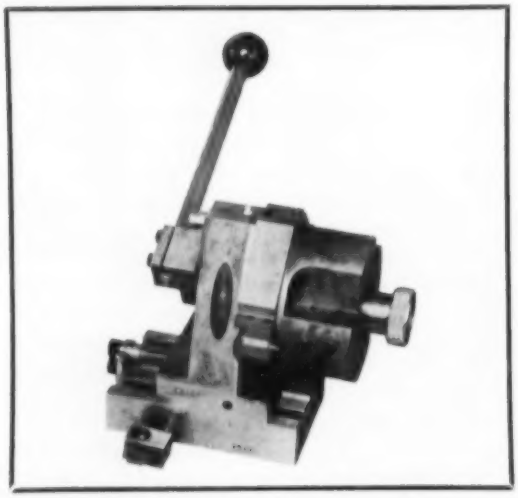


Fig. 4. Basic tool block with an external tool turret in position. All cutters are preset on a gage before the turret is placed on the machine.

to do all the machining at the tailstock end of the machine and to hold the tubes on expanding air-operated mandrels. This also made it easy to accommodate the different length and sizes of tubes. Product specifications required careful tool design analysis to insure maximum rigidity.

The tailstock, *Fig.* 2, has a stationary quill that carries a rotating, expanding sleeve. This sleeve is operated by a double-acting rotating air cylinder. There is a deep recess in the quill right behind the expanding sleeve. When tubes need internal machining, they are mounted to overhang the sleeve and the recess allows space for the tool block, tools and chips.

An air-operated expanding mandrel, *Fig.* 3, is mounted on the machine spindle. It supports and drives the workpiece, and moves longitudinally for loading and unloading. When retracted, the sleeve abuts the face of the work-spindle adapter. All movements of the spindle and mandrel are controlled by a 12-inch double-acting rotary air cylinder mounted on the rear of the work spindle. To protect honed bores, the mandrel can only expand when the spindle is extended. Rounded corners and polished surfaces also prevent scoring.

During loading of the machine, pneumatic work locators, *Figs.* 2 and 3, translate light hand pressure on the workpiece into motion in any direction. Parts can be carefully guided on and off the tailstock quill. A stop locates the tube longitudinally at the headstock end.

A basic tool block, *Fig.* 4, performs all multiple

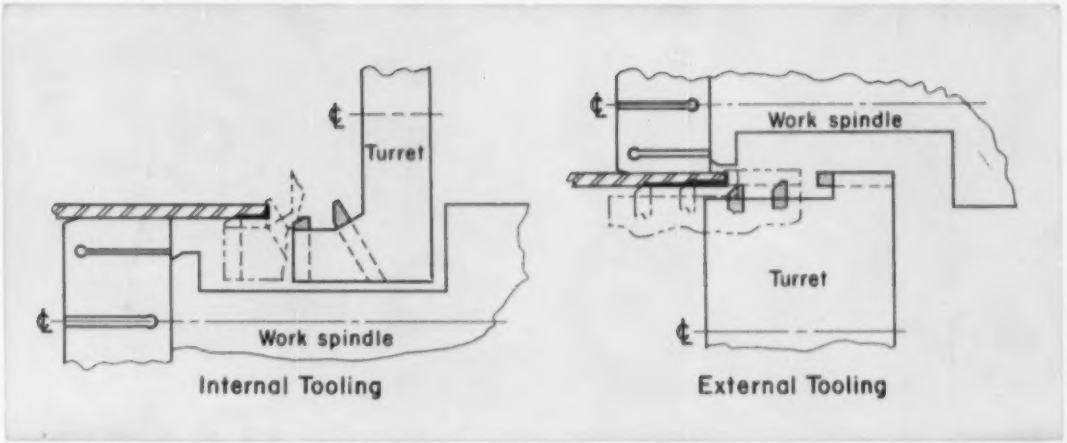


Fig. 5. A typical internal operation, left, includes rough boring and facing. A typical external operation, right, includes rough turning two diameters and facing. Phantom view shows end of cutting strokes.

machining and threading operations. Tools are mounted in interchangeable turrets. There are separate turrets for internal and external operations for each type of cylinder. To minimize down time, tool turrets are made in triplicate. One is in use, another is ready to use and the third is being reconditioned. Individual cutters are positioned in the turret by using a special setting gage. This gage compensates for accumulative tolerances and location of the tools. All tools are carbide tipped.

Typical internal and external operations are shown in *Fig.* 5. All threading operations are accomplished with single-point tools. The complete machining operations on one external end comprise; rough turn and face, finish turn and chamfer outside, chamfer inside and thread.

The design for this tooling was carefully thought out and as carefully executed. It operates as anticipated and requires only a minimum initial adjustment period. There were no major "bugs." This successful solution to a real problem illustrates the progress that can be made by cooperation among machine users, sellers and producers.

Judicious Heating Eases Brazing Job

Time and assembly steps required to produce a strong, brazed joint have been minimized at the Automatic Transportation Co., division of The Yale & Towne Mfg. Co., by taking advantage of the effect of heat on capillary flow characteristics of molten silver brazing alloy.

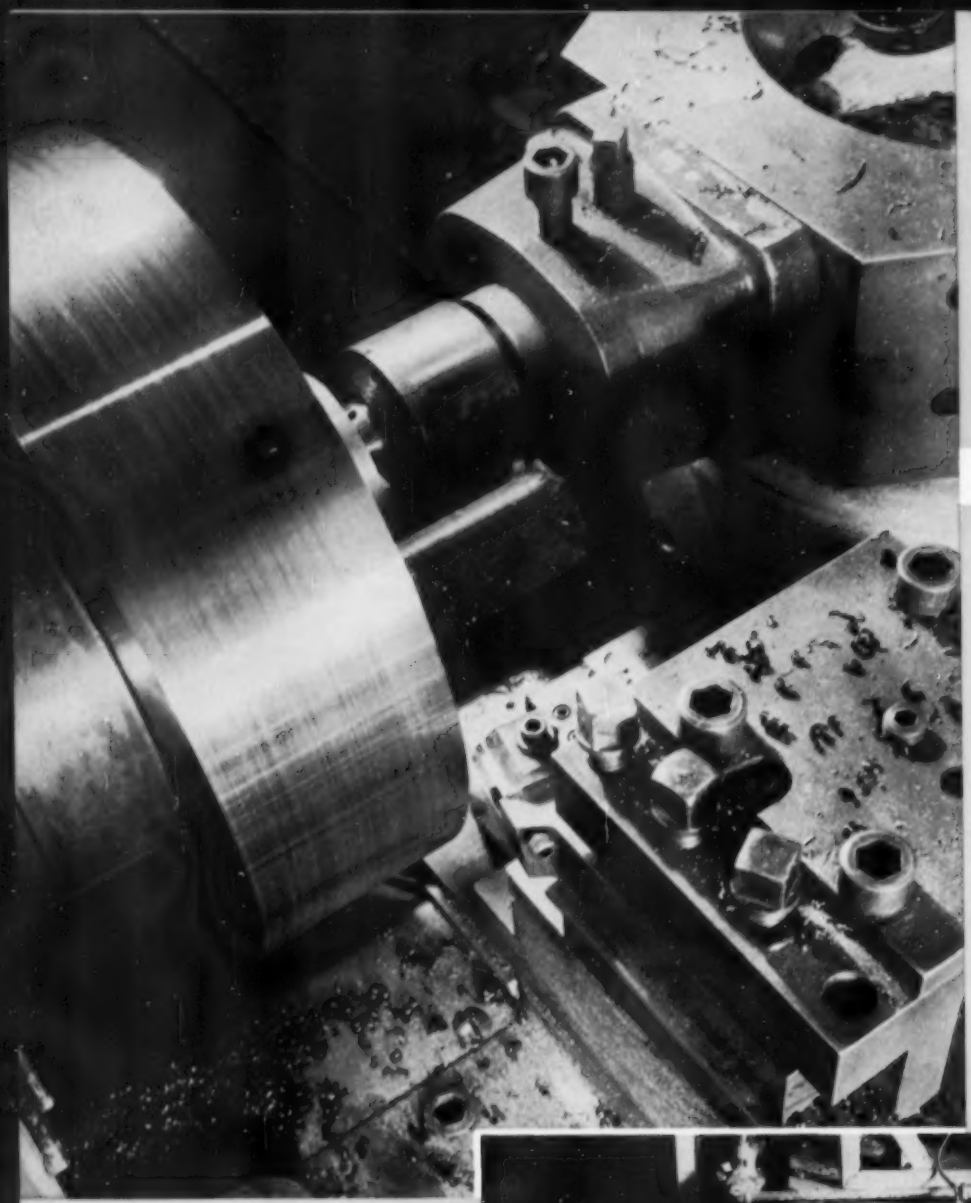
The part involved is a 7-inch steel brake lever used on many industrial trucks. Two parts make up the lever: a $\frac{3}{8}$ inch diameter steel rod, threaded and bent to the required angle, and a heavy handle fabricated from $\frac{3}{4}$ inch hexagonal bar stock. To provide a socket for seating the rod, the end of the handle is drilled to a depth of $\frac{3}{4}$ inch. Radial clearance is maintained at 0.003 to 0.004 inch.

The brake lever is made by brazing the rod into the socket, using one ring of a Handy & Harman low temperature silver brazing alloy with a flow point of 1145 F to make the joint. Drawing the alloy down into the socket from the face of the handle where the alloy ring is preplaced during assembly presents a problem in brazing this joint.

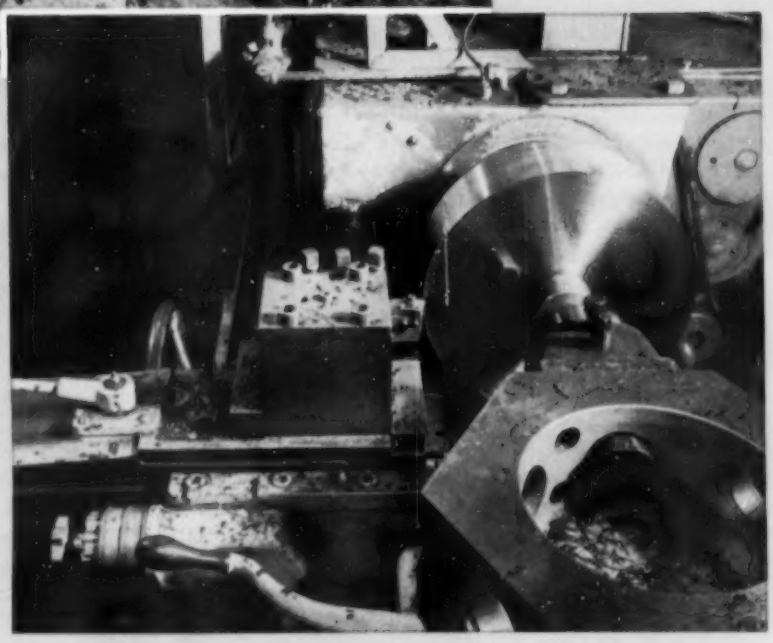
Key to uniform distribution of brazing alloy into the socket is location of the heat source. Molten silver alloy always moves toward the relatively hottest area of the metal, thus the heat source can be used to guide the alloy flow. Silver alloys flow by capillary action, and this action increases as the temperature is raised.

Brazing setup consists of a three-turn induction coil with a drilled out block below the coils into which the hexagonal handle is seated. When the assembly is properly seated, the upper coil is slightly below the level of the alloy ring. As a result, heat is concentrated along the length of the socket so that the alloy is drawn from the relatively cool upper surface down into the interior. Without the capillary flow, additional alloy would have to be preplaced inside the socket—involving an extra assembly step as well as additional machining steps to locate the alloy inside the joint.

Brazing a rod into a blind hole presents a tricky problem unless precautions are taken to allow the entrapped air to escape during the heating cycle. If there is no escape path, internal pressure can shift alignment of the assembly or resist entry of the alloy.



Ceramic tool cutting at a rate of 16,454 fpm sets an unofficial record. The operation occurred as part of research project conducted at Ohio State University for Warner & Swasey. Feed of 0.011 ipr and cutting depth of 0.040 in. were used.



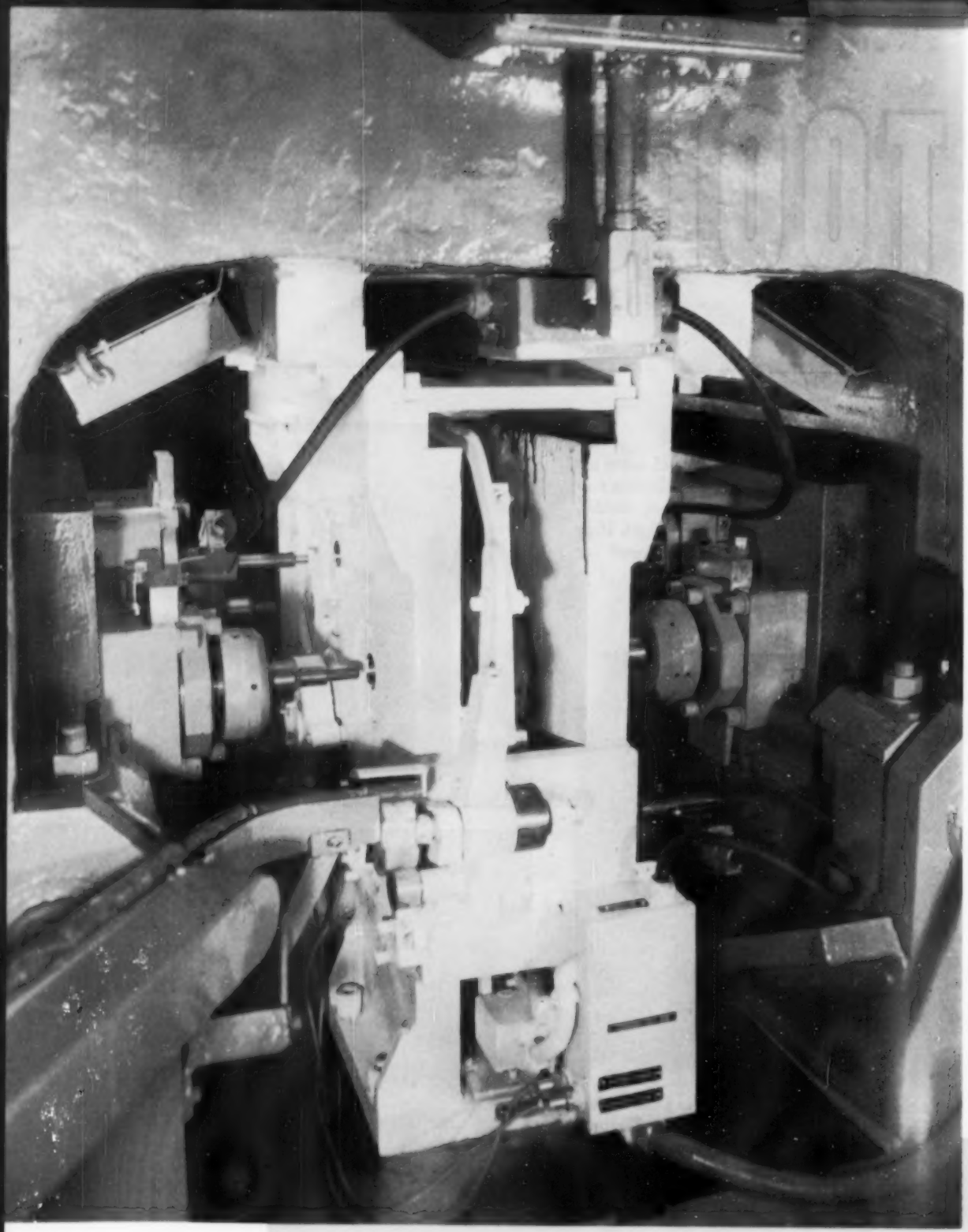
Setup utilized a turret lathe with workpiece bolted to machine spindle and supported by center mounted on the turret. The blank was 13-inch-diameter piece of 1040 steel, approximately 3½ inches long. Mechanical clamping was used to hold the ceramic cutting tip. Life of cutter allowed completion of only one cut per tool edge.

TOOLS at work

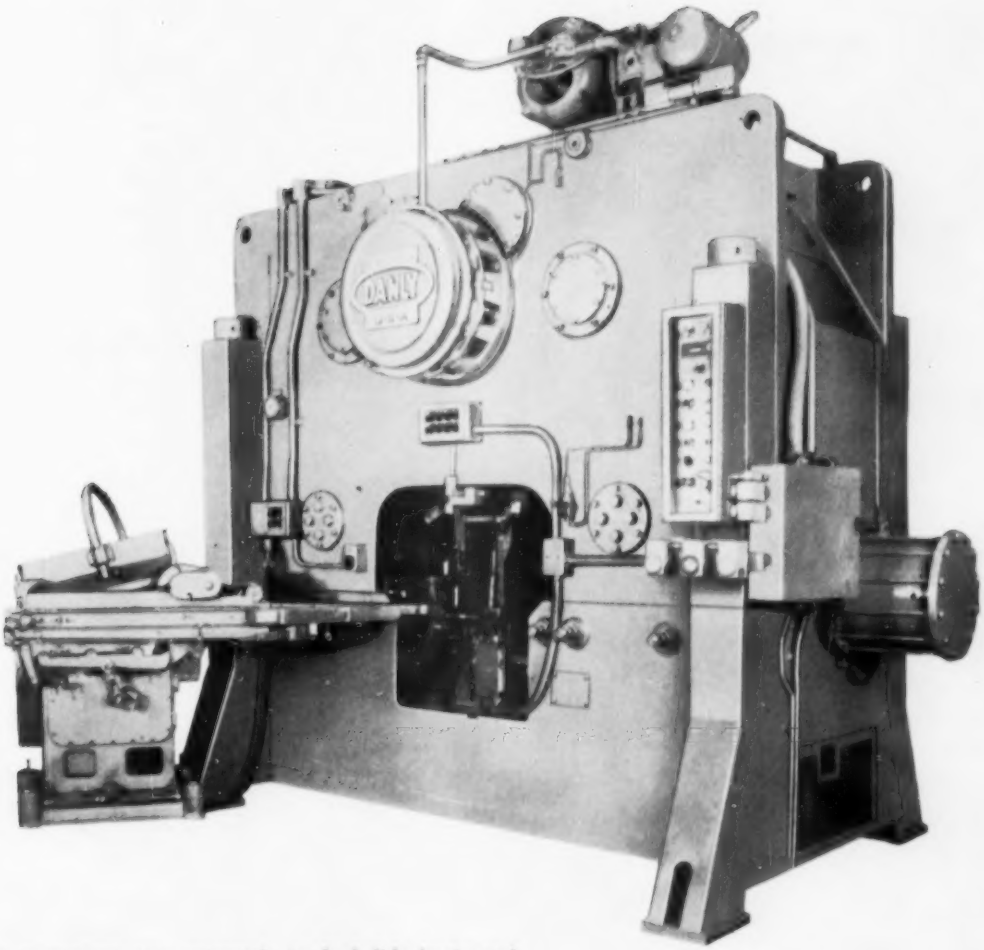
Forming of sheet metal cover of room air conditioner is handled in combination tangent bender and multiple spot welder, Westinghouse East Springfield Plant. Here the bottom of cabinet is positioned for welding.

Spot welding with multiple electrodes joins bottom of cabinet with side and top wrapper. Wrapper is sheared to size, notched and pierced, and has flange rolled prior to forming in the tangent bender.

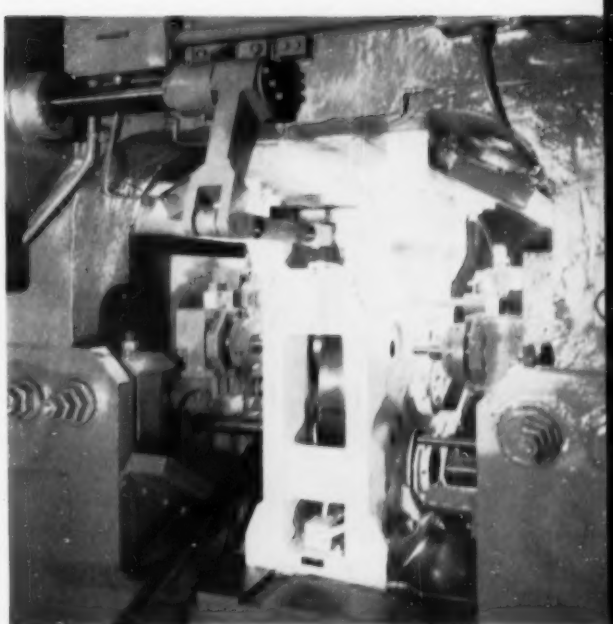
Expanding of copper tubes for the refrigerant circuit. This intermediate step in manufacture of the condenser and evaporator insures intimate contact of tubes with aluminum radiating fins to provide maximum heat exchange efficiency.

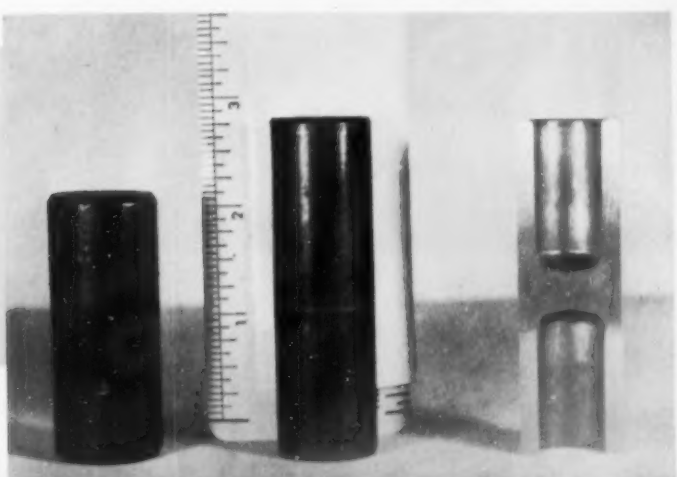


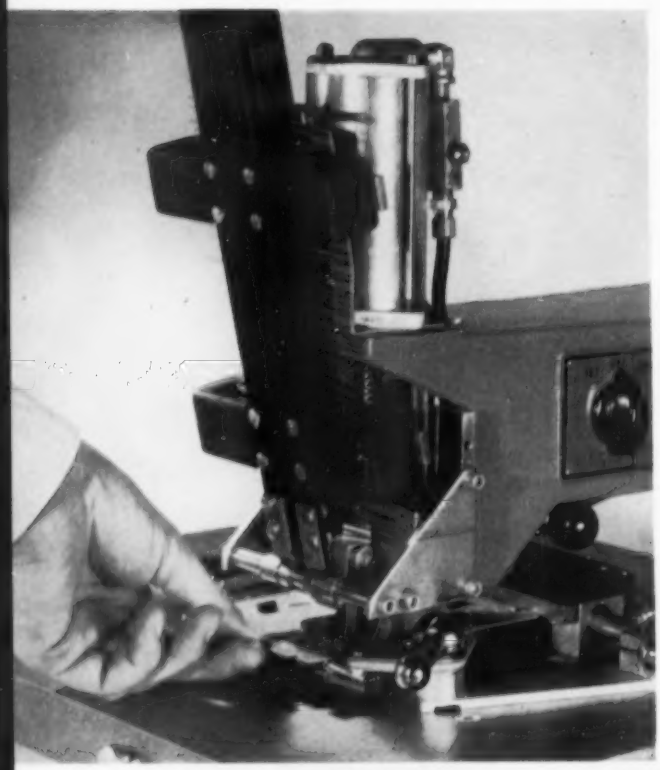
TOOLS at work



COLD EXTRUSION goes automatic in dual-slide horizontal press. Production is about 2500 pieces per hour with the hopper providing continuous flow of lengths of bar stock into dial feed. (At left) stations in the dial die provide for these operations: load, extrude, probe, size, knockout and idle. The piston pin (below) is produced at a materials saving of 43 percent over conventional production. Improved physicals are secured and machining is eliminated. Index mechanism is shown lower right.







Automatic processing may utilize small, inexpensive machines as well as large transfer machines. The Autofab, designed by General Mills Mechanical Div. to assemble cylindrical components on printed-circuit boards, is a case in point. A circuit board is simply inserted in the fixture, energizing the electromagnetic workholder. The resistor is automatically fed, leads are trimmed and formed, the part is inserted, and the leads are crimped on the underside for a firm mechanical connection.

TOOLS at work

Automatic torque control on individual nut runners speeds assembly of electrical components at GE Industry Control Plant, Roanoke, Va. By setting torsion bar of Ingersoll-Rand tool at 22 lb-ft, overtorque and stripped threads are eliminated in assembling shunt support to arcing horn. In the operation, steel cap screws are mated into bronze threads.

mechanized production

...planning the plant for · efficiency · safety · flexibility

By Robert A. Wason
Associate Editor

Not every company has the chance to start out fresh with a new plant but when the opportunity comes, a company should be ready to make the most of it. In this article, a technique for matching plant to product is detailed.

As a natural consequence of successful process planning some companies are now applying the same philosophy to "plant development." Instead of cramming equipment into an existing building, regardless of the optimum production layout, these companies are planning their products and production layouts, and then developing a physical plant that can encompass the necessary equipment in the best production order. Because products can change, these companies are building-in area and structure flexibility to meet future production needs. The highly mechanized small-motor plant of Westinghouse Electric Corp., located in Upper Sandusky, Ohio, is a good case in point.

About five years ago, Westinghouse decided to start production of motors for the fan and air-conditioning industry. None of the three plants in the small-motor division had facilities for making motors suitable for this industry. Motors for fans and air conditioners are different in size, design and construction than small motors already being produced for other uses.

The division was faced with two major problems: design a suitable line of motors; and design, plan and build a plant to produce the motors as efficiently as possible while maintaining high standards of quality and safety. Because the division was starting from scratch, it was able to closely coordinate motor and plant design to take full advantage of the most modern thinking in both fields.

Motor Design: In arriving at the decision to manufacture motors for fans and air conditioners, Westinghouse surveyed needs of the industry. Throughout the survey, one need was continually emphasized by potential users. They wanted a mo-

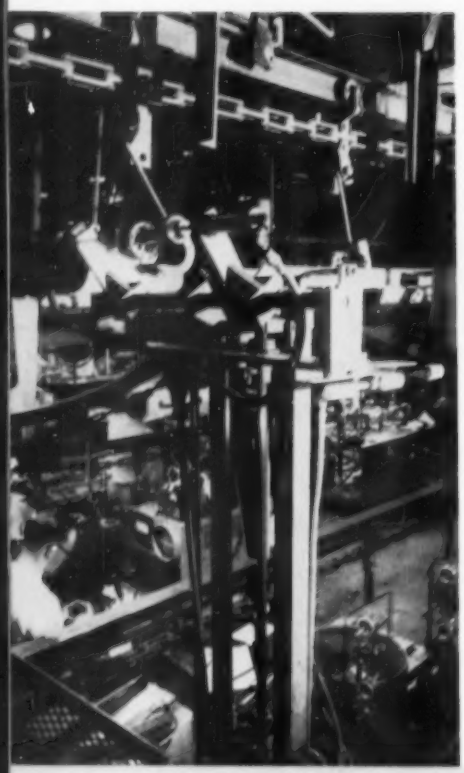


Fig. 1. Rotors are automatically retrieved from upper conveyor by this elevator device and transferred to the assembly conveyor at a lower level. This is just a part of the extensive conveying system in this plant.

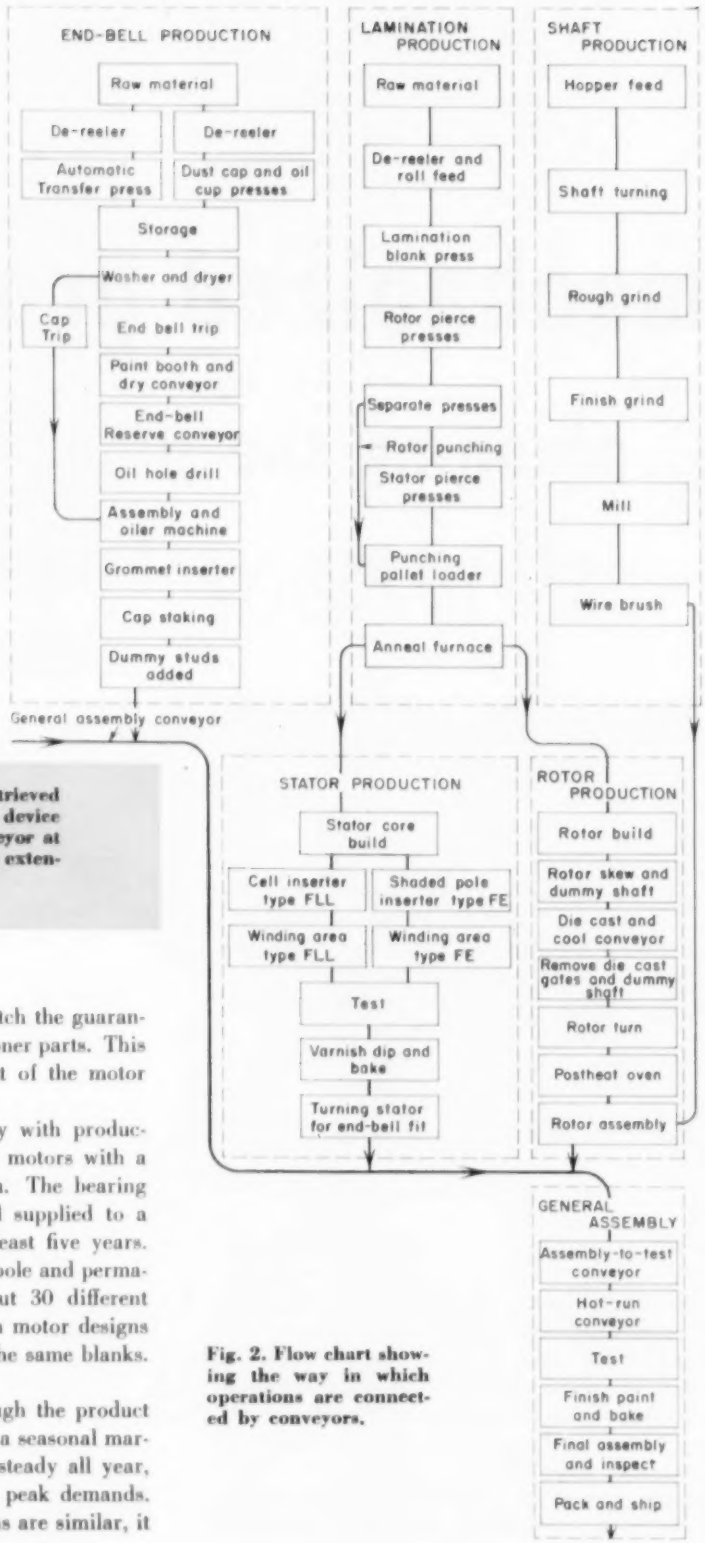


Fig. 2. Flow chart showing the way in which operations are connected by conveyors.

tor with a five-year guarantee to match the guarantee period of other major air conditioner parts. This need was made a basic requirement of the motor design.

Design engineers, working closely with production engineers, developed two basic motors with a new bearing and lubrication system. The bearing is self-aligning and the original oil supplied to a large reservoir is sufficient for at least five years. This design is used on both shaded-pole and permanent-split capacitor motors in about 30 different styles and sizes. Some parts of both motor designs are identical or can be made from the same blanks.

Production Approach: Although the product of this proposed plant was aimed at a seasonal market, production was planned to be steady all year, stocking in slack months to handle peak demands. Because the parts for the two designs are similar, it

was possible to plan for highly mechanized production. In fact, had this plant been planned just three years earlier, with the then conventional methods and equipment, its productivity level would have been only half that of this plant.

All work-in-process is conveyorized, *Fig.* 1, until it becomes a finished product ready for shipment. The various conveyors are paced to equipment and operator speeds, and have ample capacity to provide temporary storage between operations, thus minimizing materials handling.

Production was planned to be handled by five basic component lines: end bells, laminations, shafts, stators and rotors. Lamination and shaft lines operate automatically and the other three are highly mechanized. An assembly conveyor passes the end of each component line, *Fig.* 2, and receives completed parts. By the time the assembly conveyor passes over the final assembly worktables, two complete sets of motor parts are on each conveyor rack.

Because it was possible to mechanize a large percentage of the operations, product quality and personnel safety were in large measure assured. Those operations requiring operators were at a minimum and attention could be focused on them to be sure the human element would not disturb the safety and quality inherent in the rest of the production lines.

This production setup was planned for a minimum of paper work. Management was interested in shipping motors out the door rather than in accumulating paper. Since production is timed by the conveyor systems, it is only necessary to let foremen know how many units of each style and design are required so they can see that the conveyors are filled with the needed materials and components.

Planning the Plant: With products designed and processes spelled out in detail, the plant almost planned itself. Decisions were made to use wide column spacing and high headroom so there would be a minimum of physical restrictions on future production changes.

Still conscious of superfluous paper, management and engineers laid out the plant as a three-dimensional model. It was possible to see and evaluate the effects of all suggested changes and this model was altered many times before the design was frozen.

As frozen, the plant layout included an area for receiving materials, more-or-less straight-line flow of manufacturing and a combination shipping-storage area at the other end. It was then only necessary to put an envelope around the layout, allowing excess areas for offices and engineering, product development, plant and personnel services, and future expansion.

The actual plant is a single-story structural-steel-frame building with 40 by 60-foot bays and 20-foot clear headroom. Total plant area is 66,000 square feet. The truss area is used for electrical bus ducts, shop air and other services. Conveyors operate at table height, truss height and at various heights between. Illumination of the work area is 35 foot-candles furnished by nine 400-watt fluorescent-mercury lamps per bay.

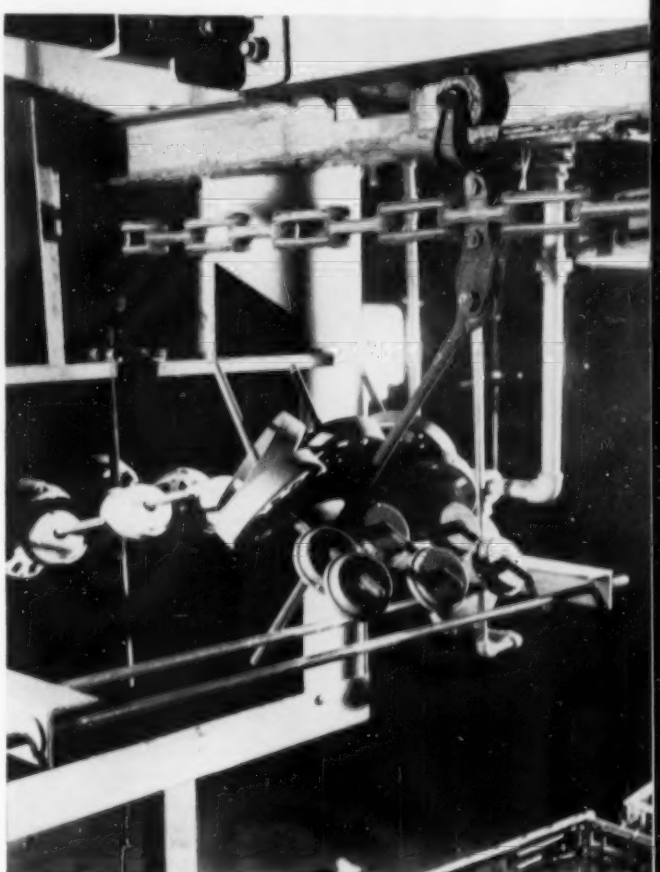


Fig. 3. Horizontal bars at end of gas-fired drier tilt chain-driven hangers to unload end caps into baskets. End bells stay on the hangers.

Bids were taken on design and construction of the plant building and a contract was awarded to The Austin Co. Once the plant was erected, the three-dimensional model was again called into play. This model had not been reduced to drawings but instead

Fig. 4. End-bell assemblies are made in a special wicking, bearing assembly and oiling machine. Oil put in wicking is sufficient for five years.

was mounted on a cart so it could be wheeled to any part of the plant. Machine and equipment setters worked directly from the model, measuring distances from the columns.

A 10-ton crane serves the length of the receiving area to handle incoming raw materials, which include silicon-steel coils for laminations, end-bell strip stock, rods for shafts and die-casting metal. A fork-lift truck is used to transfer these materials to the start of production lines, to transfer some partially finished materials in baskets and to load cartons of finished motors at the shipping dock. All shipping is done by truck so that plant location was not limited by rail facilities.

Production Methods

Because so much could be planned in advance, the production methods in this plant are optimum for a product that must have quality and long life built into it. Both the product and the methods of making it will change in the future but right now this plant is a picture of good tool engineering. Sufficient flexibility of area is included in the design so that future changes should not interfere with the application of good tool engineering.

Work stations are laid out so operators can coordinate the flow of in-process materials. These stations are located so that the operator makes a contribution to the product while transferring parts from one conveyor to another. This is done in such a way that individual efforts are balanced and fatigue is not a factor.

End-Bell Production: A dereeler passes coil stock through a straightener and roll feeder to a 600-ton automatic transfer press. This machine has a ten-station progressive die system to blank, form, pierce and trim end bells at a rate of 25 per minute. A shuttle type positioning rack runs the length of the press. After each operation of the press, a pair of arms closes on each end bell, moves it one step, positions it on the die, retracts and then returns to its original position. A sensing pickup shuts off the press if any bell is not properly positioned and a photoelectric eye protects the operator. Completed end bells are discharged into large wire baskets to be taken by fork-lift truck to the next operation.

Bearing caps are formed on manually operated progressive presses. Finished parts are loaded into baskets. From the baskets, an operator loads the end bells and caps on chain-driven hangers that carry them through an automatic washing and drying cycle to remove die compound and add a phosphate coating. As loaded hangers move out of the gas-fired drier, two horizontal bars at the exit tilt

the hangers, *Fig.* 3, letting the caps fall into baskets. These baskets are trucked to the end-bell assembly area. End bells are automatically stripped from the hangers later and slide down a chute into a hopper at the paint station.

The end bells are painted with lacquer and air dried automatically after they are manually loaded on conveyor-driven rotating pedestals. Freshly painted end bells are then transferred to a storage conveyor. At the assembly area, oil and drain holes are drilled in the end bells by semiautomatic pneumatic drills. Assembly of end bells is simplified through use of a special wicking, bearing assembly and oiling machine, *Fig.* 4. This machine comprises a hydraulic press, a 12-station indexing table, an automatic oil-tube inserting device, two oil measuring and oiling stations, and a bearing cap orienting and inserting device.

Component parts are manually positioned, and automatically oiled and assembled. They are then automatically transferred to the grommet-inserting and bearing-cap staking machines. These machines consist of four-ton presses and fixtures and are semiautomatically operated. When studs are required for customer-mounting purposes, they are added using pneumatic screwdrivers and table fixtures. Completed end bells are manually transferred to the final assembly conveyor.

Lamination Production: Laminations are automatically processed after coil stock is manually loaded onto a dereeler. Stock is roller fed to the punch press, where eight punchings (cookies) are produced per stroke at a rate of 33 strokes per minute. Cookies fall into a hopper that positions them for pickup by a nearly vertical magnetic belt, *Fig.* 5. This belt transfers the cookies to an overhead conveyor that moves them to feed hoppers at the start

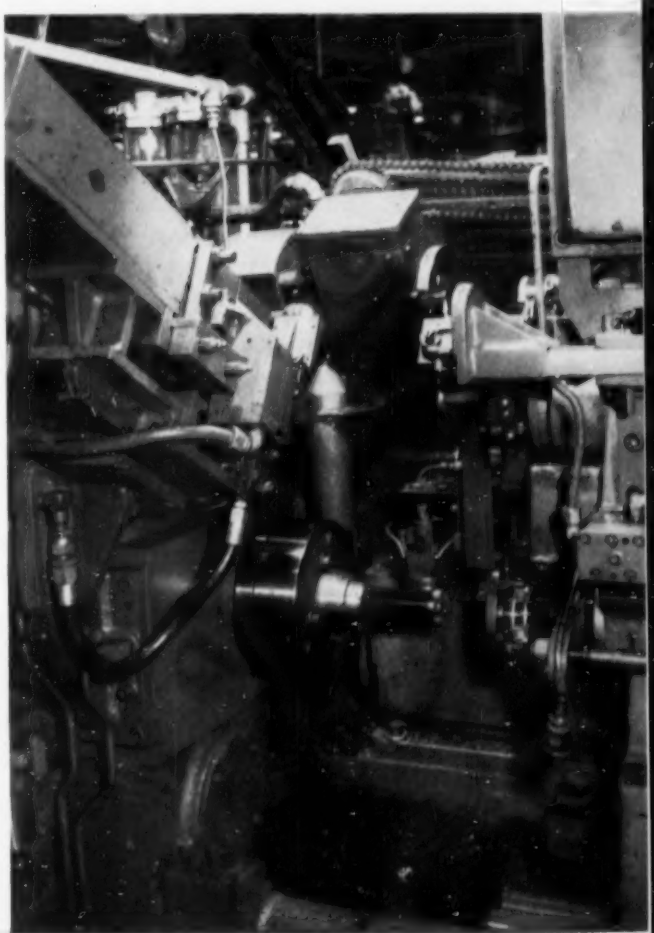


Fig. 6. (above) Unloaded lathe in which rotors are automatically loaded, turned, gaged and transferred to the postheat-oven conveyor. Feedback from gage automatically indexes circular tool when parts are oversize.

Fig. 5. (left) Cookies from press fall into hopper at left where they are picked up on an almost vertical magnetic belt. Overhead conveyor feeds cookies to tube type hoppers at start of two lamination press lines.

of the two lamination-punching lines. There are three presses in each line. The first pierces the cookie, the second separates the rotor from the stator punching and the third pierces the latter.

A sensing device, located on the feed hopper of the first lamination press, controls the output of the cookie press. When cookies in the hopper reach a predetermined level, the cookie press is stopped until a predetermined minimum level is reached. Levels of punchings in the feed hoppers for number two and three presses are controlled in the same way by actuating operation of the preceding press.

Cookies are stripped from the feed hopper singly by a shuttle type mechanism and picked up by chain-driven dogs that draw the punching over the tungsten carbide die. These presses operate at 124 spm. The punching is retrieved from the die by a magnetic shuttle type tray and forwarded to a conveyor that carries it to the feed hopper of the next press. Presses are electrically interlocked to stop automatically when a miscut or other failure occurs.

Rotor punchings are transferred from the second press through a wire tube and are automatically loaded on stainless-steel pallets on the annealing furnace conveyor. Stator punchings are moved by magnetic conveyor from the third press and are manually loaded over bars on the annealing furnace pallets. (Equipment is under development for doing this operation automatically.) These bars rise for loading and fall for transfer so that punchings are stacked on edge to prevent sticking during anneal.

Underfloor conveyors carry chopped scrap from the cookie and lamination presses, through the side of the building and up an inclined conveyor. An oscillating chute then distributes scrap evenly across the bed of a truck trailer. Other plant scrap is loaded in special baskets, which are carried to the scrap area, tilted and emptied by fork-lift truck.

When the electrically fired furnace discharges a pallet at the exit end, the door at the entry end opens and admits another pallet. The controlled atmosphere furnace is automatic and has stand-by power to permit idling without attendants on non-working shifts. At the end of the anneal cycle, pallets are conveyed to the stator and rotor core areas where storage conveyors are provided for excess rotor and stator punchings until needed. Empty pallets are transferred to a lift and a gravity return conveyor.

Rotor Production: Rotor punchings are assembled in stacks and are semiautomatically pressure-measured by a machine consisting of a press, a three-station indexing table and a punching-height indicator. The laminations are automatically oriented by vibrating the stack over three stationary pins until lamination vent holes line up over the pins. Then, rotor skew is obtained by a fixture containing three helical pins that are inserted through these vent holes. Dummy shafts, which are short

Fig. 7. Stator punchings on pallets, background, are conveyed from the annealing furnace and assembled into core stacks for pressure measuring. The rotating machine with bullet-shaped arbors, foreground, orients laminations. The boxes between arbors contain stator rivets.

arbors, are then pressed through the rotor stack to facilitate later production operations.

Rotors are then conveyed to the die-casting machine where the stationary face of the machine is manually loaded with four rotors. The moving half of the die closes, molten aluminum is manually ladled into a well and the machine takes over. When the die opens, a retriever arm moves into the die area and catches the casting as it is automatically ejected. The arm retracts and deposits the four-core unit onto a cooling conveyor.

The operator removes the cooled rotor units from the conveyor and places them on a hydraulic trimming press that strips the rotors from the gate and removes the dummy shafts. Rotors are then automatically fed on a conveyor to a lathe that loads, turns, gages and transfers the part to the postheat oven.

The lathe, *Fig. 6*, has a three-position fixture on the tailstock. It strips the rotor from the incoming conveyor, rotates 120 deg and presses the rotor on a fixed arbor. After the outside diameter is turned, the fixture rotates another 120 deg and positions the rotor on an automatic air-gaging device. If the rotor is gaged over or under, it drops into one of two reject troughs. If it is within tolerances, it drops into a conveyor and is fed to the postheat oven.

A circular tool is used on this lathe in a toolholder with 48 indexed stops. This results in a tool with 48 cutting edges. If a part gages off size, the tool automatically indexes to a new position. This is accomplished through feedback control from the gage. If the machine cannot bring parts back into tolerance, it shuts itself off.

Postheating of the rotor is required to slightly separate the laminations and the die casting to improve electrical performance, and expand the rotor for shrink-fit assembly to the shaft. Rotors are inserted in the oven, cycled and retrieved automatically. The shaft is manually assembled to the rotor and the assembly is then transferred to the rotor conveyor. Rotors are retrieved from this conveyor by an elevator device, *Fig. 1*, and transferred to a lower level to the assembly conveyor. This device adjusts itself for different shaft lengths.

Stator Production: Stator punchings are assembled into core stacks and pressure measured by a machine consisting of a press and a punching-height indicator, *Fig. 7*. Core stacks are placed on a four-station indexing table and laminations are oriented by filtering over rotating bullet-shaped arbors. As the lamination spins and slides down the arbor, a small keyway on its outside edge matches a key on a stationary fixture at the station.

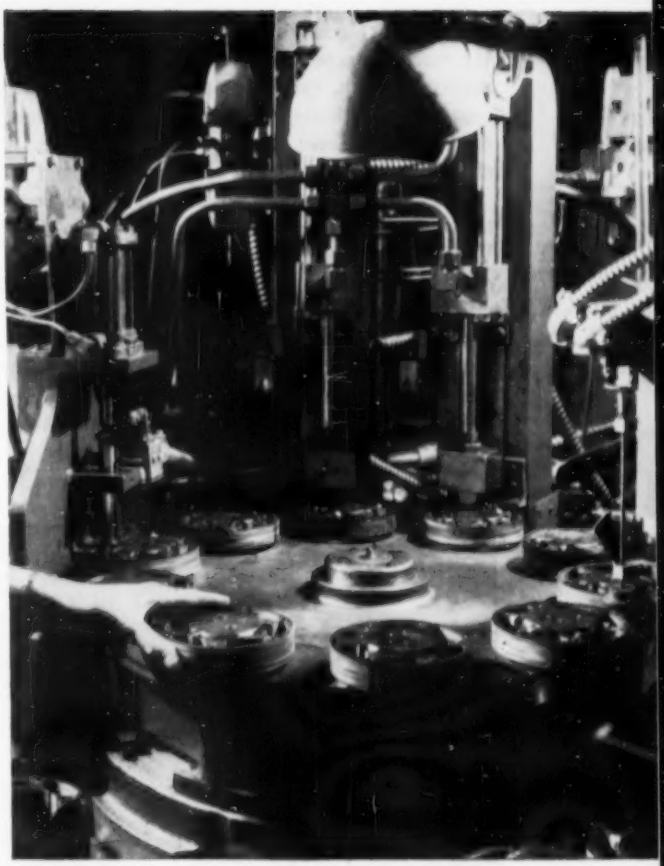


Fig. 8. (above) After manual loading, this machine automatically inserts copper strips to shade the poles of a motor.

Rivets are inserted manually from convenient boxes located on the indexing table.

Stator cores are manually loaded in the riveting machine, which consists of a press and a fixture. During the riveting cycle, the press also burnishes the inside diameter of the core. A retriever arm positions the stator cores so they can be placed on the next conveyor.

To insert slot cells in the permanent-split capacitor stator core, the core is manually loaded into an indexing fixture. The cell is formed from coil, inserted into core slots and cuffed automatically. Copper coils to provide electrical shading for the shaded-pole-motor stator are inserted on a ten-station indexing table, *Fig. 8*. This table is surrounded by a coil-inserting device, and crimping and welding stations. The core is manually loaded but the remainder of the cycle is automatic.

The stator winding area, *Fig. 9*, is divided for shaded-pole and permanent-split capacitor designs,

and winding machines are provided for each. Winding machines consist of a three-wire needle bar, an indexing chuck, turn counter and a wire-tension control. Coil-winding forms are manually installed on the stator core; the core is positioned in the chuck; and the winding of all poles is automatic.

When thermal protection is used in the motor, the bimetal unit is inserted manually in the winding. Winding coils are connected and leads added as required, using the wire-twist acetylene-burnoff method. Winding end-turns are shaped on a hydraulic press using a shaping fixture. Windings are then tested for shorts, grounds and opens by comparison with a standard core, using the surge method.

Varnish impregnation of stator insulation is automatic. Two wound stators are suported on their outside diameters on a chain-driven hook, and six stators are dipped simultaneously in a rise-and-fall varnish tank. They are then conveyed through a gas-fired baking oven.

From the baking oven, stator cores are conveyed to two lathes that turn end-bell fits on the stator ends. The core is supported by an expanding arbor. The machine tailstock supports the arbor and shields the winding. Whipping of leads is prevented by this shielding. Finished stators are then placed on the final assembly conveyor.

Fig. 9. (right) Although many operations in winding the stator are automatic, numerous operators are required to keep up with the rest of the plant production. This area has the highest concentration of operators at any location in the plant.

Shaft Machining: Shaft machining is completely automatic. Ten-foot lengths of shaft stock are loaded on an automatic-feed machine that places the bar on an automatic-bar machine where it is chamfered and cut off. Bar blanks are chain-driven to and between two centerless grinders for rough and finish grind. Finish-ground shafts are chain driven to an automatic straddle mill where flats are added. Shafts are then stored until ready for shrink assembly to the rotor core.

General Assembly: All components necessary for two motors arrive at the general assembly area on a single conveyor hanger. There are two 3-station progressive assembly lines with the conveyor moving between. The first operator positions one end bell, the rotor and the stator on a belt-driven fixture. The second operator positions the second end bell, feeds the leads through the lead hole and inserts the through bolts. The third operator uses a three-headed pneumatic screwdriver for running screws in, checks end play and connects the assembled motor power lines on to the test conveyor.

From general assembly to the test booth takes about ten minutes and permits the motors to reach normal operating temperature. The motor is automatically tested for grounds on the test conveyor. In the soundproof test booth, electrical operating characteristics and noise are checked.

At the finish paint area, dust caps are assembled to the motors. They are placed on conveyor-driven rotating pedestals and automatically sprayed with enamel. At the end of the baking cycle, the motors are cooled, identifying decals are added and the motors are packed in cartons for shipment.

The careful planning that preceded building and equipping of this plant has resulted in an excellent manufacturing facility. Location of the plant was determined only after studying sites in about 30 small communities. In a basically agricultural area, this plant has developed a dependable workforce of men and women who, because of the day-work basis established for the entire plant, are keenly interested in keeping their products competitive. Operating personnel have the equipment with which to do just that.

Honing Speeds

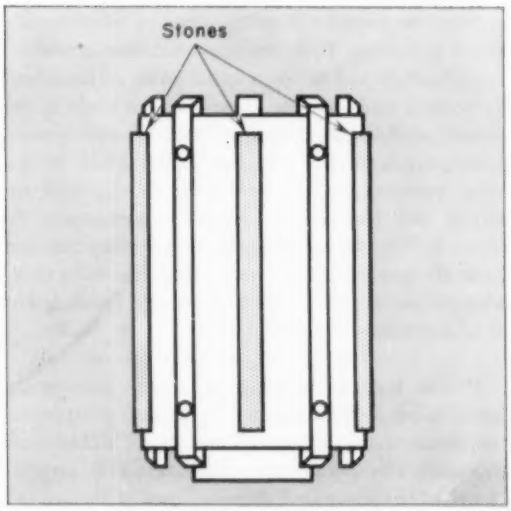


Fig. 1. Bore honing tool head.

Fig. 2. As a honing tool is revolved and reciprocated in a bore, the stones follow a helical path.

HONING IS USED ON internal and external cylindrical surfaces to remove stock, to correct diametric inaccuracies of roundness or straightness, and to generate size and finish to desired tolerances. Essentially, honing is a stock removal operation. It can be used for both roughing and finishing operations; however, it is never used to correct hole position or axial alignment. Honing of bores is usually preceded by boring or reaming operations. From 0.002 to 0.005 inch of stock is usually left for honing on high-production applications; however, the amount of stock left for honing is sometimes much greater. For example, it is not unusual to remove 0.120 inch of stock from the diameter of stainless steel tubing without any previous machining operation.

The honing process has been applied to finishing workpieces with diameters ranging from 0.25 to 60 inches and lengths ranging from fractions of an inch to more than 90 feet. Any finish within the range of 1 to 100 microinches, rms, can be consistently maintained.

The Honing Process: In honing, abrasive stones are applied to the work surface in varying combinations of arrangement, pressure, speed and direction of motion. Honing stones are rectangular in shape and contain abrasive grains held together by a bonding material.

For honing internal bores, these stones are placed at regular intervals around the periphery of a honing tool head, *Fig.* 1. During honing, the stones are forced outward from the center of the head with constant pressure. At the same time, the tool head is rotated and reciprocated within the bore. The stones follow a helical path, *Fig.* 2. gen-

Data furnished by Barnes Drill Co., Rockford, Ill.

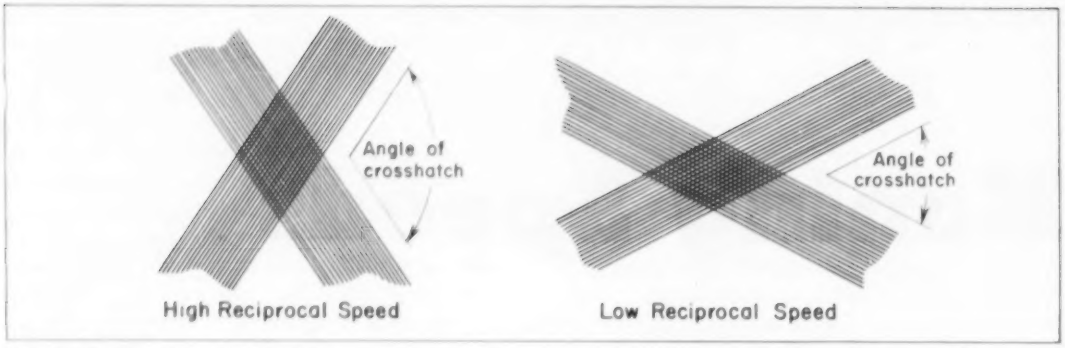


Fig. 3. Angle of crosshatch is increased as reciprocation speed is increased with respect to rotation speed.

erating a characteristic crosshatch pattern, *Fig.* 3.

As already mentioned, the honing stones are under constant pressure during the honing cycle. This pressure is applied to the push rod of the honing tool, *Fig.* 4, and is transmitted by means of cones to the individual wedges and pressure plates behind the honing stones. This provides the necessary force to secure and maintain the desired degree of penetration of the cutting edges of the abrasive grains into the work.

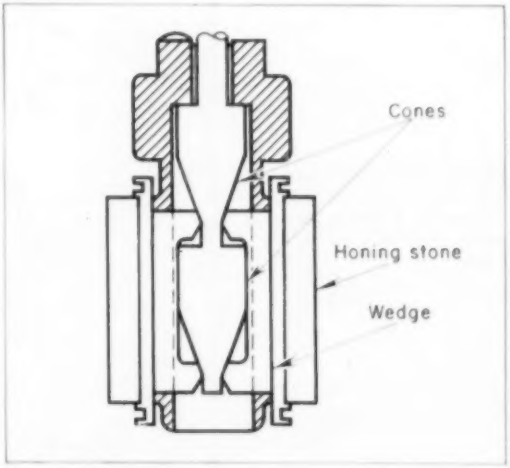
Stock Removal: Removal of stock by honing is accomplished by a shearing action in which the bonded abrasive grains act as cutting tips. The rate of stock removal depends on the physical characteristics of the workpiece material and the "balance" of the honing tool, which includes the number, size and length of honing stones, range of hone feed rate and amount of support of the stones near their cutting edges. Other variables, such as the size of the abrasive grains in the honing stones, the physical characteristics of the bond materials, machine capacity, and type and clarity of coolant also affect the rate of stock removal. Generally speaking, coarse abrasive grains and a soft bond provide the fastest stock removal.

While the individual chips generated by honing are small, the combined amount of chips produced by the great number of abrasive grains in contact with the work surface provides a rate of stock removal that in some instances is faster than grinding. For example, average stock removal with a triple-bank tool head on steel tubing is 0.015 to 0.020 inch per foot per minute. With a single-bank tool, average stock removal for cast iron is 0.006 to 0.008 inch per foot per minute. On hard steel or chrome plate, the rate averages 0.003 to 0.004 inch per foot per minute.

Surface Finish: Several variables affect surface finish in honing. These include stone characteristics, reciprocation and rotation speeds; rate of hone feed (pressure) and coolants. Fine abrasive grain in the stones produces finer finishes than coarser grains. Increasing bond hardness lowers the profile of the stone surface, also giving a finer finish. Fast rotating and reciprocating speeds cause stones to glaze, in most cases, decreasing the cutting rate but generating a smoother finish. High viscosity coolants are an aid in producing smooth finishes, but slow down the cutting action.

Power Requirements: In honing, horsepower input must be sufficient to rotate and reciprocate the hone under the maximum permissible wall pressure. The horsepower requirement is proportional to the combined abrasive area of the honing

Fig. 4. Pressure on cones is transmitted through wedges, pushes stones outward from center of tool head.



stones acting on the work surface, multiplied by the wall pressure, multiplied by the helical speed in feet per minute.

Stroke: Stroke is the term applied to movement of the honing tool in either direction of spindle travel in the bore being honed. The work stroke must include a small amount of overtravel at each end to balance the contact of the honing stone for all areas of the surface and attain diametric straightness of the bore. The work stroke can be determined by adding the length of the bore and the overtravel at both ends and subtracting the length of the honing stone. Overtravel should be approximately one-third the length of the honing stone, *Fig.* 5. For example: to finish a 9-inch-long bore using 4-inch-long stones, an overtravel of $1\frac{5}{16}$ inches would be required. Work stroke would be $7\frac{5}{8}$ inches.

Helical Speed: Recommended speeds for honing are usually expressed in terms of helical speed. This speed is determined by rotation speed and reciprocating speed. Rotation speed and reciprocation speed can be depicted as two sides of a right triangle. The hypotenuse of this triangle is the path of travel of the honing stone and also indicates helical speed, *Fig.* 6. Helical speeds for honing various materials are shown in TABLE 1.

Calculating Reciprocation and Rotation Speed: The rates of reciprocation and rotation required to produce a specified crosshatch angle in a bore of given diameter at given helical speeds can be calculated trigonometrically. Extensive calculations can be avoided by using TABLES 2, 3, and 4.

Example: Given a crosshatch angle of 40 deg, a helical speed of 200 fpm and a bore size of 3.000 inches, find the correct rotation and reciprocation speeds. TABLE 2 shows that the peripheral speed for a 40-deg crosshatch angle and 200-fpm helical speed is 187.9 fpm. Rounding off this value to 190 fpm, it is converted to the correct value for a 3.000 bore diameter, 243 rpm, using TABLE 3. The correct reciprocation speed for a 40-deg crosshatch angle and 200-fpm helical speed is 68.4 fpm, TABLE 4.

Table 1—Recommended Honing Speeds

Material	Approximate Helical Speed (fpm)
Soft Steel	120 - 160
Hard Steel	75 - 120
Cast Iron	200 - 230
Aluminum	230 - 250
Soft Bronze	230 - 250
Hard Bronze	200 - 230

Fig. 5. Work stroke equals length of bore plus length of overtravel at both ends minus length of the stone.

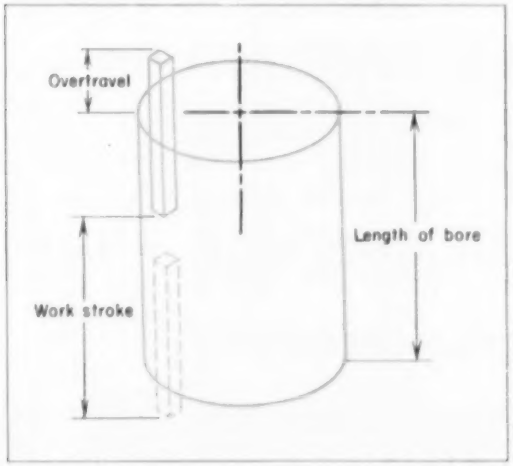


Fig. 6. Relationship between rotation speed, reciprocation speed and helical speed.

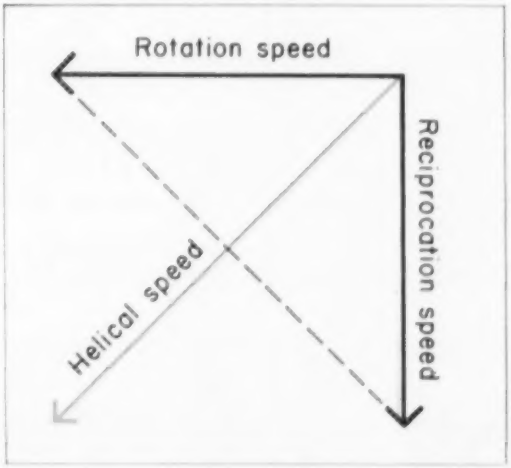


Table 2—Relationship of Helical Speed to Peripheral Speed for Given Crosshatch Angles

Crosshatch Angle (deg)	Helical Speed (fpm)																
	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
	Peripheral Speed (fpm)																
30	78.2	87.0	96.6	106.1	116.0	125.5	135.0	145.0	154.5	164.0	174.0	183.8	193.5	202.8	212.5	222.2	231.8
31	77.1	86.7	96.4	106.0	115.6	125.3	134.9	144.5	154.2	163.8	173.5	183.1	192.7	202.4	212.0	221.6	231.3
32	76.9	86.5	96.1	105.7	115.4	125.0	134.6	144.2	153.8	163.4	173.0	182.6	192.3	201.9	211.5	221.1	230.7
33	76.7	86.3	95.9	105.5	115.1	124.6	134.2	143.8	153.4	163.0	172.6	182.2	191.8	201.4	210.9	220.5	230.1
34	76.5	86.1	95.6	105.2	114.8	124.3	133.9	143.4	153.0	162.6	172.1	181.7	191.3	200.8	210.4	220.0	229.5
35	76.3	85.8	95.4	104.9	114.4	123.9	133.5	143.1	152.6	162.1	171.7	181.2	190.7	200.3	209.8	219.4	228.9
36	76.1	85.6	95.1	104.6	114.1	123.6	133.1	142.7	152.2	161.7	171.2	180.7	190.2	199.7	209.2	218.7	228.3
37	75.9	85.3	94.8	104.3	113.8	123.3	132.8	142.2	151.7	161.2	170.7	180.2	189.7	199.1	208.6	218.1	227.6
38	75.6	85.1	94.6	104.0	113.5	122.9	132.4	141.8	151.3	160.7	170.2	179.6	189.0	198.6	208.0	217.5	226.9
39	75.4	84.8	94.3	103.7	113.1	122.5	132.0	141.4	150.8	160.2	169.7	179.1	188.5	198.0	207.4	216.8	226.2
40	75.2	84.6	93.9	103.4	112.8	122.2	131.6	141.0	150.4	159.7	169.1	178.5	187.9	197.3	206.7	216.1	225.5
41	74.9	84.3	93.7	103.0	112.4	121.8	131.1	140.5	149.9	159.2	168.6	178.0	187.3	196.7	206.1	215.4	224.8
42	74.7	84.0	93.4	102.7	112.0	121.4	130.7	140.0	149.4	158.7	168.0	177.4	186.7	196.1	205.4	214.7	224.1
43	74.4	83.7	93.0	102.3	111.7	121.0	130.3	139.6	148.9	158.2	167.5	176.8	186.1	195.4	204.7	214.0	223.3
44	74.2	83.4	92.7	102.0	111.3	120.5	129.8	139.1	148.3	157.6	167.0	176.2	185.4	194.7	204.0	213.3	222.5
45	73.9	83.1	92.4	101.6	111.0	120.1	129.3	138.6	147.8	157.1	166.3	175.5	184.8	194.0	203.3	212.5	221.7
46	73.6	82.8	92.1	101.3	110.5	119.7	128.9	138.1	147.3	156.5	165.7	174.9	184.1	193.3	202.5	211.7	220.9
47	73.4	82.5	91.7	100.9	110.0	119.2	128.4	137.6	146.7	155.9	165.1	174.2	183.4	192.6	201.8	210.9	220.1
48	73.1	82.2	91.4	100.5	109.6	118.8	127.9	137.0	146.2	155.3	164.4	173.6	182.7	191.8	201.0	210.1	219.2
49	72.7	81.8	90.9	100.0	109.1	118.2	127.3	136.4	145.6	154.7	163.8	172.9	182.0	191.1	200.2	209.3	218.4
50	72.5	81.6	90.6	99.7	108.8	117.8	126.9	135.9	145.0	154.1	163.1	172.2	181.3	190.3	199.4	208.5	217.5
51	72.2	81.2	90.3	99.3	108.3	117.3	126.4	135.4	144.4	153.4	162.5	171.5	180.5	189.5	198.6	207.6	216.6
52	71.9	80.9	89.9	98.7	107.9	116.8	125.8	134.8	143.8	152.8	161.8	170.8	179.6	188.7	197.7	206.7	215.7
53	71.6	80.5	89.5	98.4	107.4	116.3	125.3	134.2	143.2	152.1	161.1	170.0	179.0	187.9	196.9	205.8	214.8
54	71.3	80.2	89.1	98.0	106.9	115.8	124.7	133.7	142.6	151.5	160.4	169.3	178.2	187.1	196.0	204.9	213.8
55	71.0	79.8	88.7	97.6	106.4	115.3	124.2	133.1	141.9	150.8	159.7	168.5	177.4	186.2	195.1	204.0	212.9
56	70.6	79.5	88.3	97.1	106.0	114.8	123.6	132.4	141.3	150.1	158.9	167.8	176.6	185.4	194.2	203.0	211.9
57	70.3	79.1	87.9	96.7	105.5	114.2	123.0	131.8	140.6	149.4	158.2	167.0	175.8	184.6	193.3	202.1	210.9
58	70.0	78.7	87.4	96.2	104.6	113.7	122.4	131.2	139.9	148.7	157.4	166.1	174.9	183.7	192.4	201.2	209.9
59	69.6	78.3	87.0	95.7	104.4	113.1	121.8	130.6	139.3	148.0	156.7	165.4	174.1	182.8	191.5	200.2	208.9
60	69.2	78.0	86.6	95.2	104.0	112.5	121.2	130.0	138.6	147.0	155.8	164.8	173.2	181.9	190.5	199.2	207.8

Table 3—Conversion of Peripheral Speed to Spindle Speed

Bore Diam.	Peripheral Speed (fpm) 70	75	80	85	90	95	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
	Spindle Speed (fpm)																				
0.250	1067	1144	1220	1296	1372	1449	1525	1677	1830	1982	2135	2286	2440	2593	2745	2898	3050	3203	3355	3508	3660
0.375	725	777	828	882	933	985	1035	1140	1245	1347	1452	1555	1658	1763	1868	1970	2075	2180	2280	2385	2490
0.500	536	574	612	650	689	727	765	842	918	995	1070	1148	1224	1301	1377	1454	1530	1607	1683	1760	1836
0.625	428	459	490	520	551	581	612	673	734	796	857	918	979	1040	1102	1163	1224	1285	1346	1408	1469
0.750	357	382	408	433	459	485	510	561	612	663	714	765	816	867	918	969	1020	1071	1122	1173	1224
0.875	306	328	350	371	393	415	437	481	524	568	612	656	699	743	787	830	874	918	961	1005	1049
1.000	267	286	305	325	344	363	382	420	458	497	535	573	612	649	687	726	764	802	840	878	918
1.125	238	255	272	289	306	323	340	374	408	442	476	510	544	578	612	646	680	714	748	782	816
1.250	214	230	249	260	275	291	306	337	367	398	428	459	490	520	551	581	612	643	673	704	734
1.375	195	209	222	236	250	264	278	306	334	361	389	417	445	473	500	528	556	584	612	639	667
1.500	178	191	204	217	230	242	255	281	306	332	358	383	408	435	460	486	512	538	562	587	614
1.625	165	176	188	200	212	223	235	259	282	306	329	353	376	400	423	447	470	494	517	541	564
1.750	153	164	174	185	196	207	218	240	262	283	305	327	349	371	392	414	436	458	480	501	523
1.875	143	153	163	173	184	194	204	224	245	265	287	306	326	347	367	388	408	428	449	469	490
2.000	133	143	153	162	172	182	191	210	229	248	268	287	306	325	344	363	382	402	420	438	458
2.250	119	128	136	145	153	162	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408
2.500	107	115	122	130	138	145	153	168	184	199	214	230	245	260	275	290	306	321	337	352	367
2.750	97	104	111	118	125	132	139	153	167	181	195	209	222	236	250	264	278	292	306	320	334
3.000	89	96	102	108	115	121	128	140	153	166	179	192	204	217	230	243	255	268	281	293	307
3.250	82	88	94	100	106	112	118	129	141	152	165	176	188	200	212	223	235	247	259	270	282
3.500	77	82	88	93	99	104	110	120	131	142	153	164	175	186	197	208	219	230	241	252	263
3.750	71	77	82	88	92	97	102	112	122	133	143	153	163	173	184	194	204	214	224	235	245
4.000	67	72	77	81	86	91	96	105	115	125	134	144	153	163	172	182	191	201	210	220	230
4.250	63	68	72	77	81	86	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216
4.500	60	64	68	72	77	81	85	94	102	111	119	128	136	145	153	162	170	179	187	196	204
4.750	56	60	64	68	72	76	81	89	97	105	113	121	129	137	145	153	161	169	177	185	193
5.000	54	57	61	65	69	73	76	84	92	99	107	114	122	130	137	145	152	160	168	175	183
5.500	49	52	56	59	63	66	70	76	83	90	97	104	111	118	125	132	139	146	153	160	167
6.000	45	48	51	54	57	61	64	70	76	83	89	96	102	108	115	121	127	134	140	147	153
6.500	41	43	47	50	53	56	59	64	70	76	82	87	94	100	106	111	117	123	129	135	141
7.000	38	41	44	46	49	52	55	60	65	71	76	82	87	93	98	103	109	114	120	125	131
7.500	36	38	41	43	46	48	51	56	61	66	71	77	82	87	92	97	102	107	112	117	122
8.000	33	36	38	41	43	45	48	53	57	62	67	72	76	81	86	91	96	100	105	110	115
8.500	32	34	36	38	41	43	45	50	54	59	63	68	72	77	81	86	90	95	99	104	108
9.000	30	32	34	36	38	40	43	47	51	55	60	64	68	72	77	81	85	89	94	98	102
9.500	28	30	32	34	36	38	40	44	48	52	56	60	64	69	73	77	81	85	89	93	97
10.000	27	29	31	32	34	36	38	42	46	50	53	57	61	65	69	73	76	80	84	88	92
11.000	24	26	28	29	31	33	35	38	42	45	49	52	56	59	62	66	69	73	76	79	83
12.000	22	24	26	27	29	30	32	35	38	41	45	48	51	54	57	61	64	67	70	73	77
13.000	21	22	24	25	26	28	29	32	35	38	41	44	47	50	53	56	59	62	65	68	71
14.000	19	20	22	23	25	26	27	30	33	35	38	41	44	46	49	52	55	57	60	63	66
15.000	18	19	20	22	23	24	26	28	31	33	36	38	41	43	46	48	51	54	56	59	61
16.000	17	18	19	20	22	23	24	26	29	31	33	36	38	41	43	45	48	50	53	55	57
17.000	16	17	18	19	20	21	23	25	27	29	32	34	36	38	41	43	45	47	50	52	54
18.000	15	16	17	18	19	20	21	23	25	28	30	32	34	36	38	40	42	45	47	49	51
19.000	14	15	16	17	18	19	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
20.000	13	15	15	16	17	18	19	21	23	25	27	29	31	32	34	36	38	40	42	44	46

Table 4—Relationship of Helical Speed to Reciprocation Speed for Given Crosshatch Angles

Crosshatch Angle (deg)	Helical Speed (fpm) 80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
	Reciprocation Speed (fpm)																
30	20.7	23.3	25.9	28.5	31.1	33.6	36.2	38.8	41.5	44.0	46.5	49.2	51.8	54.4	56.9	59.5	62.1
31	21.4	24.0	26.7	29.3	32.0	34.7	37.4	40.0	42.7	45.4	48.1	50.7	53.5	56.1	58.8	61.5	64.1
32	22.0	24.8	27.5	30.3	33.2	36.0	38.5	41.3	44.0	46.7	49.5	52.2	55.0	57.9	60.6	63.4	66.2
33	22.7	25.7	28.4	31.2	34.1	36.9	39.8	42.6	45.4	48.3	51.1	54.0	56.8	59.6	62.5	65.3	68.2
34	23.4	26.3	29.2	32.2	35.1	38.0	40.9	43.9	46.8	49.7	52.6	55.6	58.5	61.4	64.3	67.2	70.2
35	24.1	27.1	30.1	33.1	36.1	39.1	42.1	45.1	48.1	51.1	54.1	57.1	60.1	63.1	66.2	69.2	72.2
36	24.7	27.8	30.9	34.0	37.1	40.2	43.3	46.4	49.4	52.5	55.6	58.7	61.8	64.9	68.0	71.1	74.2
37	25.4	28.6	31.7	34.9	38.1	41.2	44.4	47.6	50.8	53.9	57.1	60.3	63.5	66.6	69.8	73.0	76.2
38	26.0	29.3	32.6	35.8	39.1	42.3	45.6	48.8	52.1	55.3	58.6	61.9	65.1	68.4	71.6	74.9	78.1
39	26.7	30.0	33.4	36.7	40.1	43.4	46.7	50.1	53.4	56.7	60.1	63.4	66.8	70.1	73.4	76.8	80.1
40	27.4	30.8	34.2	37.6	41.0	44.5	47.9	51.3	54.7	58.1	61.6	65.0	68.4	71.8	75.2	78.7	82.1
41	28.0	31.5	35.0	38.5	42.0	45.2	49.0	52.5	56.0	59.5	63.0	66.5	70.0	73.5	77.0	80.5	84.1
42	28.7	32.3	35.8	39.4	43.0	46.6	50.2	53.8	57.3	60.9	64.5	68.1	71.7	75.3	78.8	82.4	86.0
43	29.3	33.0	36.7	40.3	44.0	47.6	51.3	55.0	58.6	62.3	66.0	69.6	73.3	76.9	80.6	84.3	88.0
44	30.0	33.7	37.5	41.2	45.0	48.7	52.4	56.2	59.9	63.7	67.4	71.2	74.9	78.7	82.4	86.2	89.9
45	30.6	34.4	38.3	42.1	45.9	49.7	53.6	57.4	61.2	65.1	68.9	72.7	76.5	80.4	84.2	88.0	91.8
46	31.3	35.2	39.1	43.0	46.9	50.8	54.7	58.6	62.5	66.4	70.3	74.2	78.1	82.1	86.0	89.9	93.8
47	31.9	35.9	39.9	43.9	47.9	51.8	55.8	59.8	63.8	67.8	71.8	75.8	79.8	83.7	87.7	91.7	95.7
48	32.5	36.6	40.7	44.7	48.8	52.9	56.9	61.0	65.1	69.1	73.2	77.3	81.3	85.4	89.5	93.6	97.6
49	33.2	37.3	41.5	45.6	49.8	53.9	58.1	62.2	66.4	70.5	74.6	78.8	82.9	87.1	91.2	95.4	99.5
50	33.8	38.0	42.3	46.5	50.7	54.9	59.2	63.4	67.6	71.8	76.1	80.3	84.5	88.8	93.0	97.2	101.4
51	34.4	38.7	43.1	47.4	51.7	56.0	60.3	64.6	68.9	73.2	77.5	81.8	86.1	90.4	94.7	99.0	103.3
52	35.1	39.5	43.8	48.2	52.6	57.0	61.4	65.8	70.1	74.5	78.9	83.3	87.7	92.1	96.4	100.8	105.2
53	35.7	40.2	44.6	49.1	53.5	58.0	62.5	66.9	71.4	75.9	80.3	84.8	89.2	93.7	98.2	102.6	107.1
54	36.3	40.9	45.4	49.9	54.5	59.0	63.6	68.1	72.6	77.2	81.7	86.3	90.8	95.3	99.9	104.4	109.0
55	36.9	41.6	46.2	50.8	55.4	60.0	64.6	69.3	73.9	78.5	83.1	87.7	92.4	97.0	101.6	106.2	110.8
56	37.6	42.3	46.9	51.6	56.3	61.0	65.7	70.4	75.1	79.8	84.5	89.2	93.9	98.6	103.3	108.0	112.7
57	38.2	42.9	47.7	52.5	57.3	62.0	66.8	71.6	76.3	81.1	85.9	90.7	95.4	100.2	105.0	109.7	114.5
58	38.8	43.6	48.5	53.3	58.2	63.0	67.9	72.7	77.6	82.4	87.3	92.1	97.0	101.8	106.7	111.5	116.4
59	39.4	44.3	49.2	54.2	59.1	64.0	68.9	73.9	78.8	83.7	88.6	93.6	98.5	103.4	108.3	113.3	118.2
60	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0	105.0	110.0	115.0	120.0

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President Harold E. Collins, left, and Past President Howard C. McMillen discuss national business of the Society on their way to the meetings.

Officers
Chairmen
Administrators

Chart Society's Course

Meeting jointly for the first time under the presidency of Harold E. Collins in Detroit, June 8 and 9, new national officers and committee chairmen outlined broad objectives and an integrated program for the coming year. Staff administrators and other headquarters personnel were also present and discussed their responsibilities in carrying out the policies of the various national committees.

Following a general meeting, vice presidents George A. Goodwin, Wayne Ewing, H. Dale Long, and William Moreland met with the chairmen of the committees assigned to them to discuss specific plans. Each of the four vice presidents, in his capacity as an ex officio member to most of the national committees, serves as a liaison between the committee and the officer group.

Convention Manager Richard Bacik, second right, points out the many aspects to his duties at national headquarters and describes the new seminar meetings which will be held in various locations throughout the country to Leslie Fletcher, left, program director; Harry Paine, national program chairman; and Vice President George Goodwin.

Vice President H. Dale Long, right, meets with V. H. Gallichotte, professional engineering chairman; A. A. Gould, education chairman, and Anthony E. Downey, staff administrator for each of these two committees.

Taking time out for luncheon are from left: Executive Secretary Harry Conrad; Past President H. C. McMillen; Treasurer J. X. Ryneska; Assistant Executive Secretary A. R. Putnam; National Education Chairman A. A. Gould; Vice President H. D. Long; National Standards Chairman J. E. Rotchford; Professional Engineering Chairman V. H. Gallichotte; vice presidents G. A. Goodwin and Wayne Ewing.

Meeting with Vice President George Goodwin, center, are from left, Program Director Leslie S. Fletcher; Staff Administrator Richard Bacik; National Program Chairman Harry A. Paine; Public Relations Manager Richard Gebers; National Public Relations Chairman George Bennett; National Membership Chairman Carl Darger; and Staff Administrator Marvin J. Bunting.

Vice President William Moreland outlines an idea for Past President H. C. McMillen and Arthur Cervenka, who is constitution and bylaws chairman.

Deep in discussion of national doings are Vice President H. Dale Long, Treasurer John X. Ryneska, Secretary David A. Schrom and National Education Committee Chairman Arthur F. Gould.

Vice President Wayne Ewing, center, discusses national programs with Donald E. Zierk, editorial chairman; John W. Greve, editor of *The Tool Engineer*; Frank E. Wilson and Willis J. Potthoff, staff administrator and vice chairman, technical publications; and John Rotchford and George Hargreaves, chairman and staff administrator for standards, respectively.

Pictured conferring are, left front row, H. Dale Long, Arthur A. Gould and Arthur Cervenka. In the back row, left, are Leonard Abrams and George Bennett.

Speakers at the morning session are shown from left; R. T. Hook, The Warner & Swasey Company; J. Roubik, Kearney & Trecker Corporation; J. J. Demuth, Chairman; H. D. Moore, The Ohio State University; and G. W. Barnes, Norton Company.

At the open-forum panel discussion, Chairman J. J. Demuth, center, stands by as technical moderators Walter G. Patton, engineering editor of The Iron Age magazine; and Robert A. Wason, associate editor of *The Tool Engineer*; make sure questions from the floor are adequately answered, and inject other questions designed to bring out any points omitted by the ceramic tool panelists.

The St. Louis chapter committee which planned the ceramic seminar was headed by Past President J. J. Demuth, center, and included from left: Dolph Boettler, W. J. Potthoff, Herman Zimmermann, J. J. Demuth, R. C. Kallemeier, Clarence Miller and Clarence Hall.

1st Ceramic Tool Seminar held in St. Louis

Because of the high interest shown in ceramic tools during the Annual Meeting in Houston, the American Society of Tool Engineers decided to introduce many of the same speakers to a different part of the country. Members of Chapter 17 requested the seminar for the St. Louis area and worked hard to make all local arrangements. Highlight of this meeting, attended by 76 people, was the afternoon open-forum panel. This was a "working" session, where participants could obtain information that would be of most value to them in applying ceramics to their production processes.

This seminar was the first meeting sponsored by ASTE on a single subject and for which registration fees were charged. For this fee, participants received copies of the Houston Ceramic Symposium papers, copies of papers presented at the seminar and the opportunity to ask questions of experts in all phases of ceramic tooling.

Because this seminar might be the forerunner of other such ASTE-sponsored meetings, results of it are being carefully evaluated. A member of the National Program Committee, Morton Blum of Cedar Rapids, Iowa, was on hand to determine the reactions of the registrants. His findings will provide a partial basis for the decision on whether to hold other seminars.

ASTE Past President J. J. Demuth headed the St. Louis seminar committee and chairmaned the meetings. Morning papers covered the physical properties, geometry and preparation, and experimental and production applications of ceramic tools. The speakers were G. W. Barnes, The Norton Company; H. D. Moore, The Ohio State University; J. Roubik, Kearney & Trecker Corporation; and Robert T. Hook, The Warner & Swasey Company.

The ballroom of the Coronado Hotel had been set up for the meeting place of the participants who were able to take notes at tables which had been provided for their convenience. A portable microphone made it possible for everybody in the room to hear questions addressed individually to speakers at the end of the morning papers.

Following luncheon, served in the anteroom of the ballroom, a paper was delivered by W. S. Humphreys, American Lava Corporation, on methods for setting up a ceramic tool program in a manufacturing plant. Bulk of the afternoon was taken up with the open-forum panel. Panel members were: E. J. Weller, Metallurgical Products Department, General Electric Company; E. Kibbitt, Stupakoff Division, The Carborundum Company; E. J. Krabacher, The Cincinnati Milling Machine Company; and W. B. Kennedy, Rodman Laboratory, Watertown Arsenal. The panel members were introduced by the technical moderators, editors of two magazines in the metalworking field, and the meeting was thrown open to questions from the floor.

Use of technical moderators did much to add interest to the forum and helped to draw maximum information from the panel members. Many questions at technical meetings are unintentionally never answered, but not at this seminar. The moderators, seasoned interviewers, and familiar with published information on ceramic tooling, made sure that the questions which were asked received answers. In addition, the morning speakers were grouped at the front of the room so they could help in answering questions.

As an indication of the value of this meeting, it is interesting to note that questions were not duplicated and few questions were asked that had already been answered by the prepared papers. Participants were there to work and they paid attention. It is also of interest that various of the panel members and speakers asked questions of each other.

Practical knowledge of tool engineering and a chance to "rub elbows" with men whose life work is in this field are two advantages offered to the would-be engineer by ASTE. As a member of one of the sixteen student chapters in colleges across the country, or as a student member of one of the senior chapters, youths planning a career in tool engineering find this early acquaintance with tooling problems most helpful in their later work.

Recent doings in the Society's student activities programs appear on these two pages. As an example, Fond du Lac chapter has initiated a student guidance program, and recently sponsored an engineering tour in order to give students a close-up of tool engineering. High school principals and instructors chose the 150 students from 23 high schools for their mechanical aptitude and interest in engineering. Following the tour, the group discussed modern engineering and design and heard Paul J. Mundie, educator and consulting psychologist outline the opportunities and challenge in an engineering career.

how ASTE aids tomorrow's engineers

Getting a taste of what ASTE has to offer were Van Dyke High School cooperative students and their instructors, guests at Macomb County's May meeting. All the boys pictured work in shops in the Detroit area and attend high school during alternate two-week periods. Shown at the rear are instructors J. D. Shuttleworth, Wally Houg, who is the vocational director of the high school, and Ed Anzicek.

Wentworth Institute student chapter held a breakfast meeting in Boston to install their officers for the forthcoming academic year. Standing are Robert Fancy, treasurer; Raymond Antetomaso, secretary; Clarence Vater, first vice chairman; Donald Lawson, second vice chairman; and Robert Chagnon, retiring chairman. Seated are James Metcalf, incoming chairman; Dr. Edward Van Dusen, dean of instruction; Installing Officer Thomas B. Walsh, past chairman and national delegate from Boston chapter; Charles Sadon, Boston past chairman; and Charles Moody, who is the faculty adviser and member of the National Education Committee.

Fond du Lac sponsors students on tour

These high school students were among 150 students with mechanical and engineering aptitudes who participated in this year's engineering trip, sponsored by Fond du Lac chapter, to the Kiekhaefer Corporation. From left they are Paul Braun and David George, St. Mary's Springs Academy; Arlo Trieglaff, Dean Seafeld, Robert Schmidt, David Rice, James Nelson, William Kinas, James Egger, and Neal Buck, all of Goodrich High.

Hudson Valley students receive charter

Newest of the Society's student chapters is Hudson Valley Technical Institute, which received its charter May 15, culminating a year of organizational work by the parent chapter, Hendrick Hudson. Shown at the chartering ceremonies are, from left: National Director Joseph L. Petz, a charter member of Hendrick Hudson chapter; Marvin Bunting, staff membership administrator; George Christianson, student chapter chairman; Gerald Scheffler, Hendrick Hudson chairman; and Oliver S. Hulley, National Education Committee. Other student officers are Donald Kwarta, first vice chairman; Carrol Westgate, treasurer; and Stewart Wagner, secretary.

Rocky Mountain chapters confer

General Chairman of the Conference Lester Detterbeck, left, is pictured with Tucson officers, J. C. Oberteuffer, delegate; J. D. Beach, chairman of the host committee; Harry DeLong, first vice chairman; J. R. Matthews, program committee; William Carlyle, chairman of the technical publications committee.

Tucson chapter was host to the Rocky Mountain Area Conference held on May 18 in Flagstaff, Arizona.

Attending the day-long sessions under the general chairmanship of Lester Detterbeck, were Director Leslie C. Seager, representing the national family, and twenty-four members from five chapters: Phoenix, Denver, Salt Lake City, Albuquerque, and Tucson.

Discussions of education, professional engineering, editorial, public relations, and membership occupied prominent positions on the program. While these meetings convened, a ladies' activities program was in full swing under the supervision of Mrs. L. G. Detterbeck. Included in their schedule was a tour of the scenic Walnut Canyon.

Those assisting Mr. Detterbeck as group chairmen of the conference were: J. R. Matthews, national program committee; F. J. Geoffroy, national standards committee; P. L. Stewart, chairman, Albuquerque; J. C. Ford, chairman, Phoenix; and R. G. Fugate and G. M. Shaw, chairman and first vice chairman, respectively, Salt Lake City.

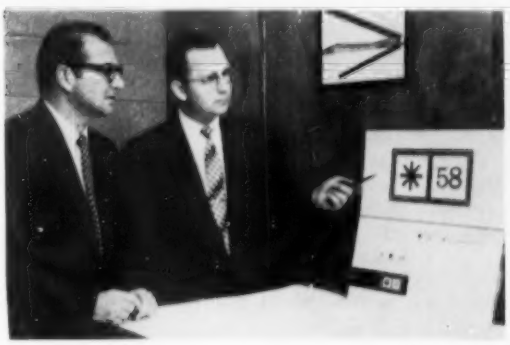
At the conclusion of this problem-solving session, L. G. Detterbeck announced that the 1958 conference will be held in Denver.

In the national SPOTLIGHT

Richard S. Thornton, 22-year-old artist from Columbia, Missouri, shows off his prize-winning design for the '58 Tool Show symbol. Show Manager Abrams' search for a symbol resulted in the sponsoring of an art design contest among graduate students at Cranbrook Academy of Art, located in suburban Detroit. The prize-winning design was selected because of its adaptability to ASTE's theme of technical progress.

Stepped-up activities in planning and executing ASTE'S 1958 Tool Show and Convention have made Tool Show Manager Leonard Abrams and newly named Convention Manager Richard Bacik two of the busiest men at Society Headquarters. Less than four weeks after the Philadelphia show was announced, 387 exhibitors had signed for display space, thus accounting for Mr. Abrams' increased activity.

The recently created position of convention manager was brought about by the Society's greatly expanded programming plans in connection with the annual, as well as the semiannual, meeting. Beginning in 1958, the latter meeting will also be a convention, including technical sessions, symposia, plant tours and women's activities.



Discussing the symbol chosen for the 1958 Tool Show are Richard Bacik, right, new convention manager; and Leonard Abrams, tool show manager. The show will be held in conjunction with the ASTE's 26th Annual Meeting and Convention in Philadelphia, May 1-8.

National Education Committee's steering committee met with the subcommittee on chapter and national level education activities, June 21 at ASTE's Headquarters in Detroit. The subcommittee is currently concerned with the writing of a die design course to be offered to members at the chapter level. Standing in front are Prof. Orville Lascoe; National Vice President H. Dale Long, ex officio committee member; Harold Linsley; Dr. Stanley Seimer, who will write the course; Education Committee Chairman Arthur Gould; Edward A. Reed, who will review the course; and Edwin L. Cutler. In back are Prof. Charles C. Lasater; Carl J. Oxford, Jr.; Prof. Kenneth J. Trigger; Oliver S. Hulley, subcommittee chairman; Anthony Downey, staff administrator.

GOLDEN GATE—A plant tour of the Enterprise Diesel Engine Co. was on the agenda at the last meeting before summer vacation. Members are observing the drilling of crankshaft holes for one of the smaller diesel engines. *—A. V. Swan*

Central Pennsylvania Host to Senior Class

National Secretary David A. Schrom, general superintendent of the York Division of the Borg-Warner Corporation, addressed 45 members of the senior class from Scotland Industrial School for War Orphans at a recent Central Pennsylvania chapter meeting. In charge of the student group were Charles Goldstrom, director of vocational education; Norman Mulac, machine shop instructor; R. L. Clarke, electrical instructor; and John Kanut, sheet metal instructor.

Also on the agenda for the evening was a tour of the S. Morgan Smith Company, followed by movies concerning trade opportunities. Mr. Schrom gave the dinner address entitled "Your Most Important Decision."

—Paul F. Leese

chapter news and views

Midwestern Industries Welcomes Wichita Tour

Wichita members touring the facilities of the Midwestern Industries plant were welcomed by Ben Carpenter, plant manager, and conducted through the plant by Fern Bassett, tool superintendent, and his associates.

Midwestern Industries is the nation's second largest producer of hydraulically operated tractor attachments for earth moving, including the back-hoe and scoop. Purpose of the tour was to observe the tooling and production methods used for this heavy type of equipment. Members viewed automatic welding processes and many units of semiautomatic arc-welding, besides press-forming operations on ¼-inch steel plate. Also of interest was the wide application of Beedy Airless paint equipment. *—W. I. Chambers*

EVANSVILLE—Guest Andrew Pollack, Ex-Cell-O Corp., is pictured talking with Professor C. R. Alden of Ohio Northern University, who spoke on "What the Engineer Should Know About Patents," and James Dawson, program chairman. *—Burton C. Ice*

North Texans Tour Alcoa Plant

Sixty-eight members of the North Texas chapter boarded buses at five a.m. to make the 160-mile trip to Alcoa's Texas Division plant at Rockdale, Texas, on May 18.

Members were divided into small groups, which toured the plant and observed the manufacture of aluminum ingots from raw materials. The plant is located in an area where lignite is mined, which is used as fuel for production purposes. The tour ended with a barbecue dinner and a relaxation period was enjoyed by everybody.

—Frank H. Scheffler

NORTH TEXAS—Members pose on the steps to Alcoa's Rockdale plant, the site of a recent plant tour. Sixty-eight members participated.

Report on Russia at Lorain County Meeting

Nevin L. Bean, technical assistant to the general manager of the Automatic Transmission Division, Ford Motor Company, spoke on Russian industrial development to members of Lorain County chapter at their recent June meeting. Mr. Bean, who inspected Russian industry in 1955, reported that the country is behind the United States industrially, but has technical developments which are very advanced. He described some plants where one section was equipped for completely automatic processes and another section was supplied with old machinery.

On his trip, Mr. Bean saw the most complete application of automation at the Kaganovich Ball Bearing Plant, the top bearing production plant in the Soviet Union. This plant produces some 1300 types of ball and roller bearings, ranging in size from 150 grams to four tons. The yearly output is approximately sixty million bearings.

While the Soviet system is not now geared to provide a standard of living comparable to ours in America, Mr. Bean commented, production facilities are being expanded rather rapidly. He added that at the current graduation rate, within a few years the Soviet will have a much larger pool of trained engineers and technicians than we.

—W. H. Little

NIAGARA DISTRICT—Chapter executives for the 1957-58 term are pictured above. Seated are: W. Snider, second vice chairman; N. Pentesco, chairman; and E. Lindwall, first vice chairman. In back are: A. Orr, treasurer; and F. Bird, secretary.

—Leo Butticci

Plastic Tooling Bibliography Available

One year's work has resulted in the completion of a bibliography of material related to plastic tooling—ASTE's Research Fund Report Number 5.

Orville D. Lascoe, professor of industrial engineering, Purdue University, authored the report, and the cosponsors are ASTE's Research Fund, Bakelite Company, Ciba Company, Incorporated, The Marblette Corporation, and Shell Chemical Company.

Instrumental in its compilation was Mrs. Carol Niss, who is a postgraduate student at Purdue.

Both subject and author indexes, as well as abstracts of the listed articles are contained in this bibliography.

Some 200 copies of this report, which is not permanently bound, have already been distributed at a reduction of half price, seventy-five cents, for members. For further information write ASTE Research Fund, 10700 Puritan Avenue, Detroit 38, Michigan.

Eleventh Annual Picnic at Erie

A well-planned picnic was held by the members of Erie chapter and drew over 55 members and 60 guests. Sports enjoyed were horseshoe pitching, shuffleboard, softball, an egg-throwing contest, and various guessing games. Members participated in a grand prize drawing with 20 prizes ranging from a hammer to a *Tool Engineers Handbook*. An ox roast and refreshments were served continuously throughout the day.

—Leo B. Weiner

Chapter News and Views

PEORIA—Robert J. Hook, center, chief metallurgist of Warner & Swasey Co., spoke to members recently on carbide cutting tools. He is shown with L. Johnson, left, chapter chairman, and Elliot Breese, planning technical chairman for the evening. *—F. J. Schumacher*

F. W. Gilbert Hosts New Haven Picnic

Cool weather favored the annual picnic of New Haven chapter which was held June 8 at the country residence of Frank W. Gilbert. The affair was organized by Stanley Weigel, with Walter Fischer in charge of the grills. Fred Dawles, past chairman of the chapter, had charge of quoits, and John Alton, horseshoes. Al Mathewson headed up the volleyball and baseball efforts.

The usual egg throw followed the ball game, but the annual hike to the old copper mine had to be dropped from the day's program, since Mr. Gilbert was unable to conduct the trip due to a recent illness.

Also in attendance was Al Pollard, another past chairman. *—S. W. Becroft*

Here's How They Did It At . . .

San Fernando Valley

"Casting" around for a suitable souvenir to present to speakers, visiting ladies and guests, San Fernando members were exposed to a spade-shaped trivet which Fox River Valley had used for similar purposes. This gave them the idea of having the ASTE emblem made in the form of "Hot Coasters."

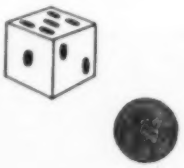
Robert Salveter of Automation Engineering volunteered to make working drawings. PatternCraft of Burbank made the pattern in exchange for bulletin advertising space. Art Lewis volunteered to order the match plate, and Compton Foundry, through its staff member, Lloyd Wallner, agreed to produce several hundred Meehanite castings free of charge.

Coast Centerless Grinding Company blanchard ground the lot; Engers Engineering, with the labor of their foreman, Robert Broomell; toolmaker Charles Fuller; tool steel supplier Tommy Tommlinson; and bull of the woods Homer Rathbun, sanded and polished them preparatory to chrome plating, done by Cadmium & Nickel Plating Company, courtesy of E. T. Brown.

Rockford

In searching for a fair and impartial method of selecting an attendance prize winner from Rockford's 454 members, who are listed both alphabetically and numerically, the powers that be decided to choose a random number and select the member by his number.

The chapter's mathematic genius, Ed Varnum, came up with the following recipe for finding a random digit:



Take a penny and a six-sided die, and toss well. Interpret the throw in the following manner:

1. Forget the aces. If the die comes up with an ace, toss it again.
2. If the penny comes up heads, add three to the point on the die.
3. If the penny comes up tails, subtract two from the point on the die.

These rules generate a single random digit. If a two-digit or more random number is required, the generation must be repeated, one throw for each digit position.

It is hoped that this information may prove valuable to other chapters with a pressing need for a method of conducting drawings.

Throw-Away Inserts Topic at Detroit

A panel symposium on carbide throw-away tools was held recently by the Carbide Section of Detroit chapter. The panel consisted of specialists and experts in the manufacturing of tools. Also on the agenda was a discussion of standards and special manufacturing applications, including boring tools and milling cutters, one of the newest types to incorporate throw-aways.

Robert Hall, entertainer, humorously told about the newer developments in tooling, including ceramics and oxide. Mr. Hall, who is also known as Carbide Specialist Van Krupp, summarized the panel discussion and entertained the audience.

Three experts participated in a panel discussion on diamond tooling at the regular section of Detroit chapter's meeting. H. C. Miller, chief research engineer for Supercut, Incorporated of Chicago, Jan Taeyaerts, president, Precision Diamond Tool Company, and Joseph Klipper, vice president and general manager of the Clipper Diamond Tool Company, pooled their collective experience and gave the general membership an interesting and informative discussion on diamond tooling. Some of the highlights covered were the manufacturing of diamond grinding wheels and tools and the application of diamond tools to precision manufacturing. Of particular interest to those attending the meeting was a movie shown on diamond mines. —*Joseph F. Wrobel*

Hydraulic Devices Discussed at Rochester

"Application of Air and Hydraulically Operated Devices" was the technical topic presented by Lester Boese of The Bellows Company at Rochester's June meeting. Assisted by William Hultgren and Walter Buell, Mr. Boese discussed air cylinders as originally designed and used. He pointed out that the old methods were not as versatile as the present-day ones and failed to do the job required in many ways.

The talk was highlighted by a film titled "Operation Push Button," which dealt with the use of air and hydraulic operations in automation. It also pointed out the advantages of using hydraulic equipment in the elimination of fatigue, the lengthening of tool life, and the elimination of rejects. A small exhibit of Bellows equipment augmented the film. —*C. W. Greenman*

GREATER LANCASTER—James Stone, left, field engineer for Nelson Stud Welding, explains the use of the stud welding gun to Chairman Folkeson.
—D. Nunemacher

Sports Night Held At Kansas City

Harold Ensley, "The Sportsman's Friend," of KCMO-TV and KCMO-Radio, spoke before a recent Kansas City meeting at the University of Kansas Medical Center on various hunting and fishing tips. Mr. Ensley gave timely advice for the field and stream sportsmen, in that he showed them how easy it is to catch a trout and gave them his system for catching various fish. His daily broadcasts include the latest up-to-the-minute information on fishing and water conditions and this information, which was presented to the members, was of great interest.
—*Joseph M. Haake*

Keystone Engineers Advised To Relax

Keith Suppler, welding engineer, Cunningham Corp., and operator of a rest lodge, advocates relaxation in the sun to ease away the tensions of the tool engineer. A sheet metal and welding shop is operated at the health camp, that Mr. Suppler described at a recent meeting, and is in current production of commercial items.

At a later meeting, C. H. Adams, Elox Corp., spoke on machining with electrical discharge. —*Frank Forquer*

WENTWORTH INSTITUTE—Installing Officer Thomas B. Walsh, national delegate of the Boston chapter, pins the chairman's button on Incoming Chairman James Metcalf, while Robert Chagnon, retiring chairman, looks on.

RACINE—At the annual spring frolic, Past Chairman Vitae Thomas, left, and Vice Chairman Lavern Hicks present prizes to one of the guests.
—*J. Thoemke & T. Bunck*

Chapter News and Views

DETROIT—Shown at the diamond tool panel discussion are: Joseph Klipper, vice president and general manager of Klipper Diamond Tool Co., Inc.; Anthony Rogers, first vice chairman of Detroit chapter; H. C. Miller, chief research engineer of Supercut, Inc., Chicago; Jan Taeyaerts, president of Precision Diamond Tool Co.; and Edward J. Novack, Detroit chapter chairman.

Niagara District Holds Annual Field Day

Niagara District's 13th annual field day, held June 14, at Oakland Golf Club in Chippewa, drew approximately 180 chapter members and guests from the nearby Toronto, Hamilton, Grand River Valley and Buffalo-Niagara chapters. The day's program included golf, lawn bowling, fly casting, a guessing game, a nail-driving contest, and a tug-of-war.

In the golf tournament, winner of the low-gross trophy for members was H. Nesbitt, and the one for nonmembers, W. Hutchinson. Second place winner was N. Coleman, also a member.

The fly-casting champion was E. O'Donough and the winning lawn-bowling team consisted of P. Sciamonte and R. Wass.

In the guessing game, the length of a rod was most closely guessed by E. O'Donough; the diameter of a disk, by J. Robbins; the length of a spring, by H. Litke; and the number of balls, by T. Legge.

Winners in the nail-driving contest were F. Barnes, F. Forrester, and G. Wickman, while the winning tug-of-war team was made up of H. Cunningham, F. Bird, L. Butticci, H. Litke, L. Evans, and A. Orr. After a full day, luncheon was served in the club house, after which prizes were distributed.

—L. Butticci

Springfield, Ill., Visits Dow Chemical Plant

The Madison, Illinois plant of Dow Chemical Company was visited by Springfield members on June 4. This plant is the largest manufacturer of both extruded and rolled magnesium and, contrary to its name, does not produce chemicals. Members viewed the process by which a 2000-pound ingot is reduced by a finishing mill to a sheet of aluminum 84 inches wide and many hundreds of feet long.

Highlight of the tour was the 13,200-ton "extruding giant" manufactured by Hydraulik of Germany. Members were impressed, not only by the sight of the huge machine, which spread over several hundred square feet of floor space, but also with the unusual way in which it was obtained. Manufactured by the Germans during World War II, it was placed into the Rhine River so that the Allies would not get it. After being submerged for several months, it was salvaged and brought to the United State by the Air Force at a cost of several million dollars. Installation of the huge machine took three years. The inventor of the machine, who went into hiding during the war, was later found and is now on the Dow staff supervising the operation of his machine.

After the tour, refreshments were served on the return bus trip.

—O. A. Steen

Donald Zierk Speaks at Seminar

Donald E. Zierk, manager of tool engineering at Elgin National Watch Company, and chairman of the National Editorial Committee, was one of the lecturers participating in the Automation Seminar at Pennsylvania State University recently. His topic was "Miniaturization and Small Parts Handling."

Case histories of the automatic handling and assembly of several small parts were covered in his discussion, along with the problems found in the miniaturization of various components and the manufacturing feasibility of these components.

Denver Celebrates Tenth Anniversary

National Director Leslie C. Seager assisted in honoring the past chairmen and charter members present at Denver chapter's recent tenth anniversary celebration. He also gave a short resume of the history of ASTE. A birthday cake was one of the highlights of the program and during the ceremony each past chairman lit one of the ten candles. Unfortunately, Past Chairman Willard Krieger, 1954-55, was unable to attend the meeting.

Stainless Steel Subject at Syracuse

"Machining Stainless Steel" was the subject of Gilbert C. Klingel, Armco Steel Corporation metallurgist, at a recent Syracuse technical meeting. Mr. Klingel listed specific points to be remembered in machining of this material. They included the recognition that stainless steels are tough, requiring harder types of cutting material, the need for shearing, rather than shaving the metal, and the necessity of rigid tool mounting in a well-supported workpiece.

Past chairmen present at the meeting were awarded "picture frame" mounted plaques in recognition of their service to the chapter and the Society.

—F. A. Verrillo

SOUTHEASTERN MASSACHUSETTS—Karl Nittel receives the third prize certificate in *The Tool Engineer* Gadgets Contest from Ray Holbrook, past chairman of the chapter. Mr. Nittel's contribution was a design for a quick-change brush head. *—Morris Bieler*

OZARK—Shown at Joplin Industrial Week sponsored by the local Chamber of Commerce, the above exhibit was set up by chapter members. Society literature and copies of *The Tool Engineer* magazine were displayed along with a colorful poster which had been designed for the event.

SAN FERNANDO—Robert Broomell, chairman, presents second prize award in *THE TOOL ENGINEER* Gadgets Contest to Robert Daly, an active member of the education committee. This was the only award received in the Los Angeles area. *—R. E. Dittrick*

Quantometers and Jets Are San Fernando Subjects

Technical Speaker J. W. Kemp explained "Production Control Quantometers" and Coffee Speaker Darwin Whetstine showed a film on the X-13 Vertiget, making Fernando Valley members who attended the June 5 meeting more conversant with two of the more recent developments of the scientific age. Mr. Kemp, who is Development Division manager of Applied Research Laboratories, Glendale, explained the design and function of the combination electromechanical and optical instrument which uses a 24,000 line original grating for dispersion of light of the spectrum to analyze test samples of inorganic materials. *—R. E. Ditrick*

members on the MOVE

David M. Andrews, New Haven, has been promoted to superintendent of maintenance at Chase Metal Works plant of Chase Brass & Copper Co.

Walter J. Holder, Buffalo-Niagara Frontier, has been appointed manager of the Micro-Klean Filter Division of The Cuno Engineering Corporation.

Matthew G. Rumora, a tool engineer for the Wiley Carbide Tool Company, has been appointed secretary of the ASTE Carbide Subcommittee. He is replacing **Guy Monacelli,** Detroit, recorder for the ASTE subcommittee since its inception in 1953. Mr. Monacelli is chairman of the Cemented Carbide Producers Association Standards Committee.

W. A. Johnson, Detroit, has been named manager of Royal Oak Tool and Machine Company's Grinder Division.

Edward J. Ambrose, Benton Harbor-St. Joseph, was appointed chief manufacturing engineer for Acme Industries.

George M. Class, Madison, vice president of engineering at Gisholt Machine Company, has recently been elected general officer of the board of directors.

Barber-Colman Company has announced the appointment of **Bruce E. Horst,** Rockford, as sales manager of the Machine Tool Division.

Fred C. Dull, Detroit, has been appointed to the offices of vice president and treasurer of The Monarch Machine Tool Company.

Harvey B. Wallace, Detroit, founder and president of Wheel Trueing Company, has received the honorary degree of Doctor of Business Administration from Mount Union College.

Roger M. Freberg, San Gabriel Valley, has been appointed assistant to the Pacific Coast manager, Jessop Steel Co.

Julian Ross Frederick, Ann Arbor Area, has been appointed assistant professor of mechanical engineering for 1957-58 at the University of Michigan.

Firth Sterling announces the appointment of **Harry Davidson** as Canadian District manager for Firth Sterling, Canada Ltd. He will continue as assistant district manager of Ohio district.

Leon A. Hurwitz, Greater Lancaster, has been appointed product manager, Metals Processing Department, Hamilton Watch Company.

M. J. Markowski, Cleveland, has resumed full-time activity with The Mark-Shaw Corporation. In addition to their engineering work, he is directing the formation of a new company to produce die castings, which will be available this summer.

chips and chatter

Hartford chapter members manned a tool engineering booth at the local Science Fair this spring. Co-sponsored by the Hartford Times and the Northern Connecticut science teachers, the fair consisted of exhibits by pupils from the seventh to twelfth grades, besides those booths set up by professional science and engineering societies. Hundreds of parents and children visited the ASTE display, where a small vibrator type of parts feeder stimulated much interest and comment.

Houston enjoyed a plant tour through Reed Roller Bit Co. Reed is one of the largest manufacturers of oil field rock bits and drill stems. Afterwards, members enjoyed a Texas-style barbecue.

Donald Nibbelink, staff member of Eastman Kodak Company, Rochester, brought to **Lansing** chapter members a behind-the-scenes analysis of picture situations and new techniques for photography fans at their most recent meeting. The technique of story telling using colored slides was covered and was profusely illustrated with kodachrome and ektachrome transparencies.

Little Rhody's June meeting had as its principal speaker George T. Atkinson of the Electric Boat Division at New London, Connecticut. Mr. Atkinson gave an enlightening talk in laymen's language about nuclear power and the importance of the atom to our future.

At **Little Rock's** June 13 meeting Dr. Lewis Porkbough, vice president and provost of the University of Arkansas, outlined plans for the new "Graduate Institute of Technology," which will be located in Little Rock. The purpose of this institute will be to help furnish local industry with technically trained personnel.

"Thirty-three Days in the Canadian Yukon" was the title of a film shown at **Mid-Hudson's** May dinner meeting by Elroy P. Gray, owner of the Gray Grimes Tool Company and the Last Word Sales Company. The movie, which was about big-game hunting, was the first nontechnical film to be shown at a Mid-Hudson dinner meeting and was very well received. An election to fill the chapter offices of first vice chairman and secretary was held. Nils Larson was chosen to replace Michael N. Hall as first vice chairman, and Attila G. V. deIlly to replace Arthur J. La Rue as secretary.

Society President Harold E. Collins made **Muskegon** his first chapter stop after returning from Ireland. Speaking at the June 11 meeting, Mr. Collins covered the broad subject of machines fixtured abroad, and made numerous comparisons between European methods and tooling and those in the United States.

On June 6 some 50 members of **Northwestern Pennsylvania** chapter met at St. Mary's for their regular dinner meeting, followed by a technical program. Thomas E. Simmons, from GE, gave an interesting lecture on automation. Sound movies on this subject were also shown and a lively question period followed Mr. Simmons' address.

Warner & Swasey's chief metallurgist, Robert Hook, was guest speaker at **Peoria's** June meeting, showing slides on the various types of brazed carbide cutting tools. During his narration of the slides he retraced some of the history of cemented carbides and suggested some of the future possible uses of carbide in cutting feeds and speed which may be devised.

Philadelphia members heard G. L. Beatty of The Cincinnati Milling speak on "Hydrospin," and W. H. Busch of Lodge & Shipley Company discuss "Floturn."

Donald M. Laflin, representing Giddings & Lewis Machine Tool Company, presented the story of tape-controlled machining to **Phoenix** members recently. A sound film showing the actual machining of an aircraft part, using paper tape for the controlling of the automatic machining, was shown.

Racine chapter garnered over 475 members and guests for its annual spring frolic, held June 7 at the Kenosha Country Club. Golfing was the order of the day and was followed by a dinner in the evening. Program Chairman John Kellogg and his committee presented entertainment which included card games and variety acts.

Riverside's current membership drive is off to a good start. Several new members were greeted by Chairman Hugh Foster at a recent meeting.

Awards were made to the winners of the Junior Engineers Contest by **Santa Ana Valley** chapter members at the June meeting. The first four winners received a drafting set and the fifth, a slide rule.

Santa Clara Valley chapter welcomed Louis A. Talamini, tooling and methods engineer for The Schlage Lock Company of San Francisco, as guest speaker, at their June 18 meeting. His talk covered the history of his company, which was a pioneer in the cylindrical lock industry, and was supplemented with colored slides showing the machines Schlage uses to make lock parts. Mr. Talamini gave a detailed description of the transfer press operations employed to make several small parts and told of the problems encountered and solved in achieving the mass production of parts, which makes The Schlage Lock Company the largest lock manufacturer in the world.

A plant tour of the Boyertown Auto Body Works was on the agenda for the June 11 meeting of the **Schuylkill** chapter. Seventy-five members saw the processes and tools used in the manufacture of truck and commercial vehicle bodies, such as those used by bakeries and dairies.

South Bend's recent meeting was devoted to the discussion of optical tooling by H. L. Nicholson of the Charles Bruning Optical Company. A demonstration of the technique was accompanied by a sound movie on the same subject.

Western Reserve members traveled to Sharon, Pennsylvania recently to tour the transformer division of Westinghouse Corporation. Preceding the tour, a movie describing the Westinghouse transformers was shown. During the two-hour inspection tour members viewed all phases of transformer production. They saw a complete range of transformer sizes, from a small "pole transformer" to a 300,000-pound transformer for use in substations.

Positions Available

WANTED — FULL-TIME TEACHER who can handle class and laboratory instruction in Tool Engineering courses at the college level. B.S. degree is minimum requirement considered for permanent position. Contact Professor Frederick Preator; Tool Engineering Department, Utah State University, Logan, Utah.

TOOL DESIGNERS—
Needed by Lockheed Aircraft near Atlanta, Georgia. Minimum 2 years' recent experience, preferably aircraft. Rate depends on experience. Liberal company benefits. Relocation assistance. Write Dept. JRD, Lockheed Aircraft Corporation, 834 W. Peachtree St., N.W., Atlanta 8, Georgia.

MACHINE TOOL SALES ENGINEER—
Chicago-Midwest area—must be acquainted with tool, die and manufacturing companies and must have knowledge of shop methods and procedures. Represent well-established concern selling new precision machine tools. Commission and drawing account. Send resume to Box 103, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Michigan.

MANUFACTURER'S AGENTS—
Growing cutting tool manufacturer requires competent agents to meet expanding plant capacities. Line consists of High-Speed Steel and Carbide cutters, selective standards and special tools. Write Niagara Cutter Division, Bollier - Damerell, Incorporated, 330 Niagara Street, North Tonawanda, New York.

Obituaries

George Acerzi, Long Island, project engineer, General Bronze Corporation.

Henry Arndt, Benton Harbor-St. Joseph, supervisor, Whirlpool Corporation.

Claude J. Brooks, Springfield, Ill., foreman, Park-Sherman Company.

Charles Ray Brunner, Detroit, former national secretary and Board of Directors member estimator and tool engineer at Chrysler Corporation.

Paul Grodzinski, member at large, diamond information head, Industrial Distributors, Ltd., London, England.

Mark Johanning, manufacturer's agent, vice chairman of National Membership Committee, and membership chairman of North Texas chapter.

Louis F. Lippa, Rochester, secretary, Genesee Tool and Die Corporation.

Emanuel Pitsch, past chairman of Wichita chapter, engineer, Rocky Mountain Tool & Die Company and formerly general manager for Agricultural Tool Company.

Charles A. Siekkinen, Twin Cities, process engineer, Minneapolis Honeywell Regulator Company.

Paul D. Strader, Western Reserve, development engineer, Youngstown Kitchen Division, American Standard.

George U. Van Train, Houston, abrasive engineer, Cortland Grinding Wheels, Incorporated.

George A. Waning, Syracuse, designer, McCarthy-Gallagher.

Coming Meetings

National

EDUCATION COMMITTEE—Aug. 17, North Shore Club, Chicago.

PROFESSIONAL ENGINEERING Aug. 24, Royal Oak, Toronto

1958 ASTE Tool Show
26th Annual Meeting
May 1-8
Philadelphia's Convention Center

Chapter

FOND DU LAC—Aug. 11, 1 p.m., Hickory Hills Country Club, Chilton, Wis. Annual outing.

MISSISSIPPI—Aug. 2, Aircraft Hydraulics; Vickers, Inc., plant tour.

MUNCIE—Aug. 9, 6 p.m., Heekin Park. Picnic; games and movies.

OKLAHOMA CITY—Aug. 6, 6:30 p.m., at Mayfair Cafeteria. "Cool Chips" and "Champions All"; films.

PEORIA—Aug. 18, 12 noon. Miller Park. Annual picnic. Children's games, bingo, softball.

RIVERSIDE—Aug. 11, 6 p.m., La Granada Plunge. Annual picnic and family outing.

SANTA CLARA VALLEY—Aug. 20, 1:30 p.m. at Norton Co., Santa Clara. "Grinding Wheel Manufacturing and Proper Use" by plant manager, Norton Co. Plant tour and movie.

SCHUYLKILL VALLEY—Aug. 16, 6:30 p.m. at The Swallows' Club, Boyertown Pike. Annual clambake.

SYRACUSE—Aug. 24, noon, at Hinerwadel's Grove. Annual clambake.

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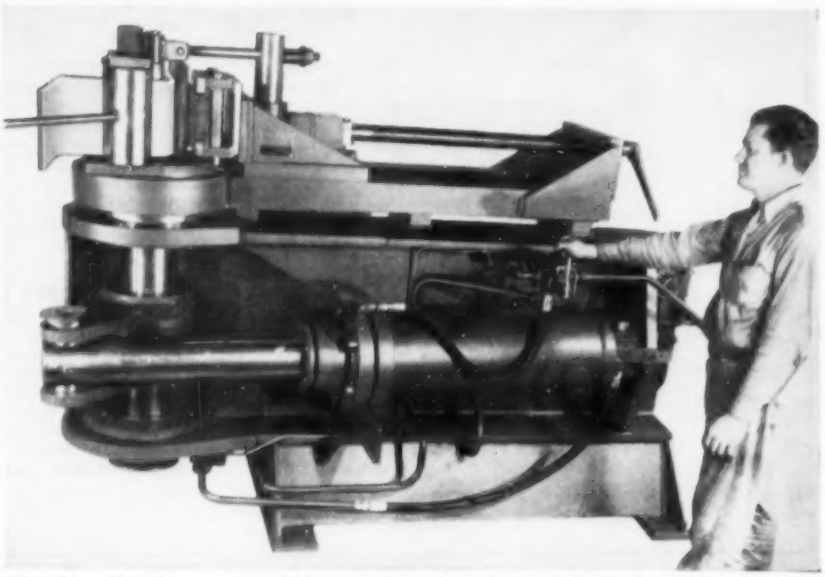

The bender shown was built to bent bus bar 2¼"x 16"

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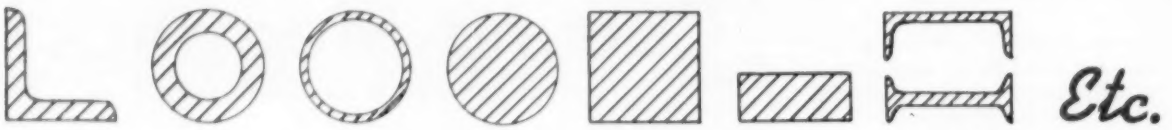

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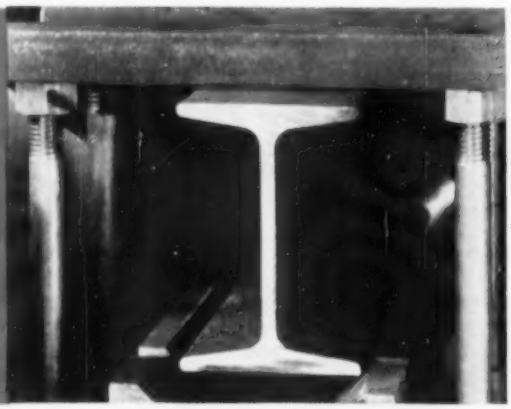

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PROGRESS IN PRODUCTION

SWARFING SPAR MILL CUTS MACHINING TIME

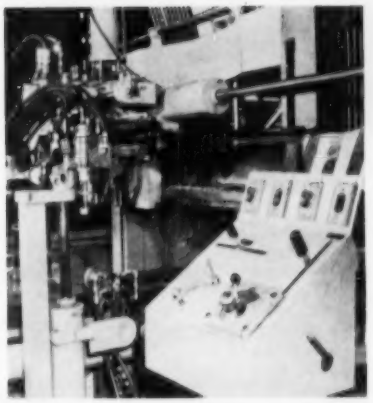
Time of machining of sculptured aircraft parts has been decidedly reduced by swarfing spar milling machines which perform full 360-deg accurate contour milling and tapering as well as swarfing. First of these machines, designed and built by Tapered Air Products Corp., was put to work at the company's Jet Spars Div. plant, attacking the backlog of fabrication of sculptured wing sections and structural parts.

Flexibility of the machine makes it capable of accomplishing variable angle cuts up to 24 deg either side of center line. Because of hydraulic controls, extremely close tolerances can be maintained on aluminum or stainless steel parts. Actually, the machine will work to plus or minus 0.002 in. within an area of 4 x 12 ft.

Using the equipment, parts requiring extensive contour milling are being turned out in a fraction of the time previously required. Some swarfing operations which have required more than an hour for completion now can be performed in as little as 20 minutes by machinists who have been given no special training to operate the mill. Only simple patterns are necessary.

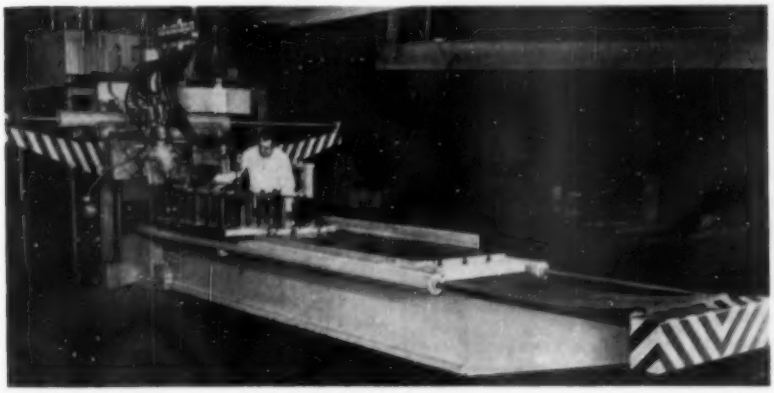
On the new equipment, cutters are powered by a 15-hp hydraulic motor. Cutting speeds are valve regulated ranging from 0 to 1800 rpm, and cutting action is controlled by simple cams.

Previous methods used by the company proved time-consuming and costly. Thus, with a backlog in fabrication of sculptured structural aluminum and stainless steel parts stretching well into 1959, the company's engineers were challenged with an urgent need for developing special machines to provide increased quality quickly and at lower cost.



Simplified control panel swivels to increase working area. Valve at left controls cutter speed; valve at right controls table travel.

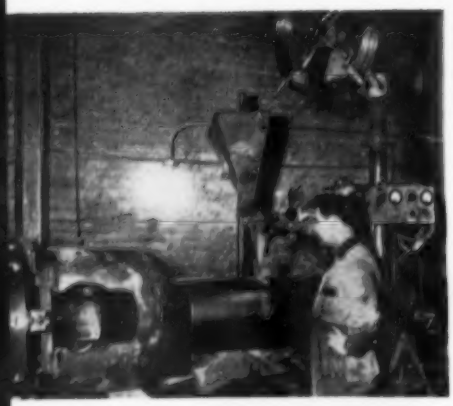
Over-all view of spar mill. This is the first of three machines to be completed by Tapered Air.



RESURFACING PROVES ECONOMY

Worn cylindrical parts that ordinarily might have to be scrapped are being hard surfaced with Unionmelt welding technique by Great Lakes Welding Co. of Detroit, saving its customers the expense of new equipment. The submerged arc welding process developed by Linde Co. Div. of Union Carbide Corp., which Great Lakes Welding uses, combines high speed and quality with low cost and labor requirements.

To accomplish the resurfacing, a special head designed for the welding



First of three passes needed to restore a 20-in. diameter on a spindle for a blooming mill drive is being made. The special head, flux hopper, wire reel and welding controls are moved by the lathe tool carriage.

method is installed on each of two lathes. One lathe handles parts up to 54 in. in diameter and 18 ft long, while the other takes pieces up to 30 in. in diameter and 12 ft long. The lathes are adjustable, permitting surfacing of different diameters on a single part.

Supported on the lathe tool carriage, the head moves automatically at a set rate, while the worn part is rotated by chucks which are driven by the headstock. The rotating workpiece is grounded by a sliding contact which bears against the outside of the chuck. Flux hopper and wire reel are positioned above the head.

Fully mechanized, controlled operation of the head results in surfacing of parts with minimum operator time. Once welding starts, the machine continues automatically with only occasional attention required from the operator. Welding speeds vary from 30 to 60 ipm, depending upon deposit thickness.

As the metal is deposited, each weld bead unites with the bead next to it, as well as with the metal below. The metal can be deposited in several layers until the original diameter of the part is restored. After the metal is deposited, the new surface is machined or ground to provide any desired finish.

NEW LAYOUT PLAN SPEEDS HANDLING

Careful attention to layout of its new stock room has relieved old bottlenecks at Brown & Sharpe Mfg. Co., so that work channels into a steady moving flow, and time required to handle materials and fill orders is substantially reduced.

Former stops and starts accumulated excessive process time, particularly at points of stock picking and shipping. Piles of orders and tools waiting to be moved, sorted and rehandled, slowed operations in the department.

Such rehandling points were bypassed in the new setup. A constantly moving belt runs through the entire department and links the stock room and shipping areas. Goods are picked from the shelves which parallel the conveyor. The belt is striped down the middle and a switch plate at the shipping room end automatically deflects the items which have been placed on one side of the stripe into the parcel post packing line and those on the other side of the stripe into the consolidation station and on to the freight and express packers.

As orders pass shipping clerk stations, goods are slid off the conveyor, wrapped, strapped or sealed, and placed back on the belt to proceed to the postage meter and scales, or to the freight strapping machine and heavy-duty scales.

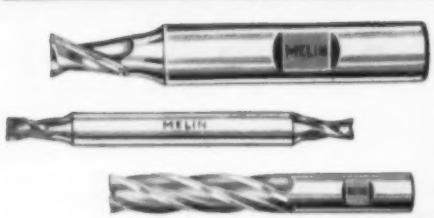
With the new stocking and shipping facility, approximately 1200 orders per day are filled and shipped, and orders now go out in one day instead of three to five days.

PRODUCE PRINTED CIRCUITS THROUGH MOLDING METHOD

Molding techniques are being used to produce printed circuits to facilitate mass production of printed wiring boards. The method uses phenolic impregnated cellulose sheet molding materials specially developed by Rogers Corp. that meet specifications up to NEMA standards for XXXP laminates

MELIN
END MILLS

There is a difference in end mills . . . MELIN end mills! Proof of this is evident in the continued increase in MELIN popularity. The growth in MELIN tool acceptance was by no means an accident . . . The secret is in *CONSISTENT QUALITY*. This standard of Quality assures you better performance . . . longer lasting performance . . . CONTINUOUSLY . . . from one shipment to another. Next time you order end mills . . . specify the finest . . . specify MELIN.



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Representatives in principal cities.

MELIN TOOL COMPANY, INC.

3372 West 140th Street
Cleveland 11, Ohio

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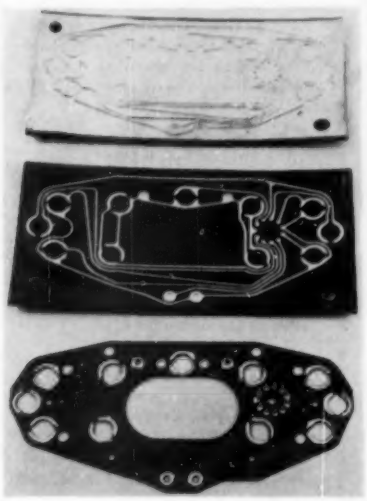
when properly molded. Three dimensional effects can be molded into the cured material at the time the circuit itself is being produced. No etching processes are involved. Supplied uncured, the materials can be molded into three-dimensional shapes with holes for component lead insertion which simplifies fabrication.

Experimentation results show that hole concentration can be twice that of punched parts, and the molding is economical and comparatively easy. Molding also allows holes to be tapered or stepped in depth. Finished boards have a resin skin seal formed over all edges and hole walls which minimizes moisture absorption.

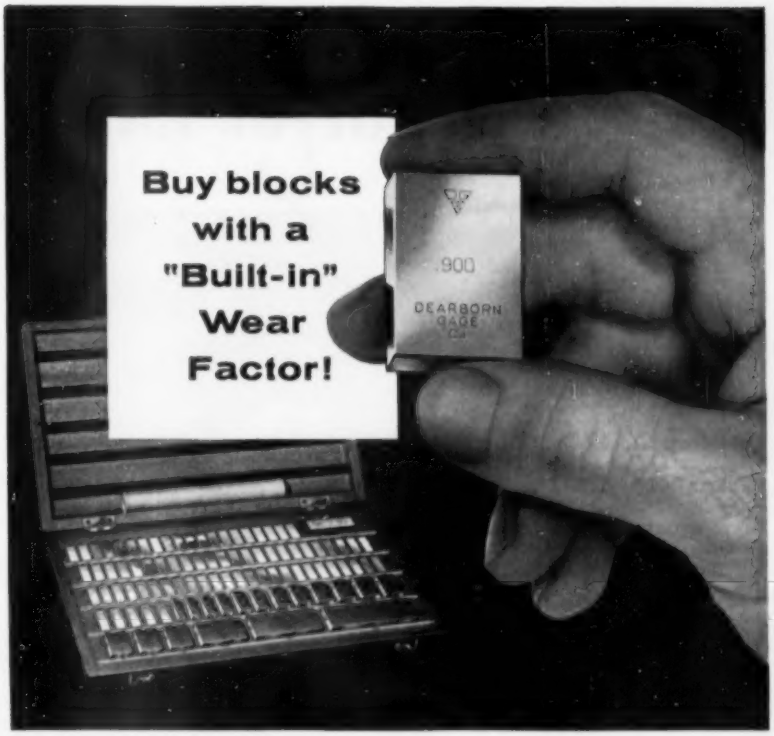
Several processes have been adapted by Rogers for producing circuits to meet



From top to bottom, steps in this molded circuit for an automotive part show: design in the copper stamped in the molding board, the pattern on the molding board with excess copper stripped away, and the completed circuit. Except for the contact points, a cover sheet protects the circuit from short circuiting.

various requirements. One of these is the die stamping process, in which an adhesive-backed continuous copper strip is stamped into the bolding board that serves as the cutting edge and female die. The punch impresses the copper below the surface of the board, adhering those parts which will form the circuit. Excess copper is stripped away prior to molding and salvaged as scrap. Standard compression molding techniques are used to complete the circuit. To further their advantage, the company devised low-cost tooling methods for making the molds.

Rogers presently plans to license companies producing printed circuits for their own use, as well as a few of those producing circuits on a contract basis.



ELLSTROM CHROMIUM PLATED GAGE BLOCKS are guaranteed "minus nothing" from nominal size!

Here at last are gage blocks with a positive "built-in" wear factor! The only blocks ever produced and priced as standard with dimensional accuracy unconditionally guaranteed to be within specified millionths on the "plus" side of nominal block size and minus "zero" . . . absolutely nothing . . . undersize!

This complete elimination of the conventional minus tolerance gives you, the gage block user, three new and exclusive benefits. First, it provides positive assurance against receiving new blocks that are actually "worn" undersize during manufacture before they are ever used. Second, it gives you finer, more practical accuracy . . . with the sure knowledge that every Ellstrom block you buy will start wearing *toward* its nominal size rather than *away* from it. And third, it gives you a guaranteed minimum wear factor equivalent in millionths to the full minus tolerance specified as standard for all other makes of blocks!

Write for descriptive literature containing complete price information today!

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Ellstrom Gage Block Accuracy Guarantee

"W"—WORKING ACCURACY BLOCKS
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Parallelism: .000004" Flatness: .000004"

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Measured Length: +.000004"/−.000000"
Parallelism: .000003" Flatness: .000003"

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Measured Length: +.000002"/−.000000"
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Ellstrom—your best buy in gage blocks for shop and tool room use, inspection and laboratory applications. Available in 28 standard sets ranging from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories.

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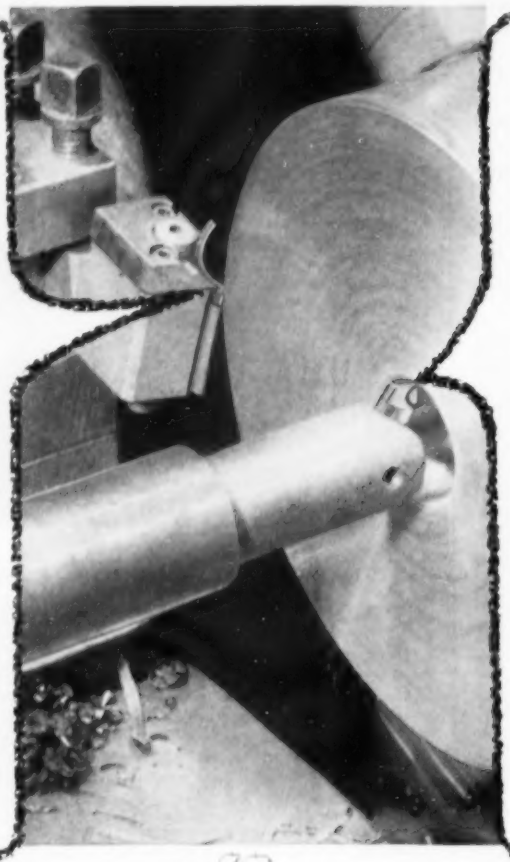
How V-R Tooling can reduce costs on your Turret Lathe Operations



High Speed Turning with New VR-75 Cemented Carbide

Surface speed dictates the choice of cutting tool material. When surface speeds are high enough to use cemented carbides, selection of a carbide grade depends upon the type of material being machined, and the amount of heat, shock and/or abrasion encountered.

Example: Turning an 8" O.D. on Arma-steel at 450 SFPM (215 RPM) with a V-R toolholder and VR-75 carbide throw-away insert. The high edge strength and high heat resistance of VR-75 carbide provides longer tool life and less downtime on this job. VR-75 is outperforming all other carbides on a wide range of steel machining applications.

Your V-R Representative or Distributor offers you a complete line of V-R quality carbides to best meet your requirements. Factory trained service engineers back the V-R line with a complete carbide engineering service. Call locally or write V-R today.

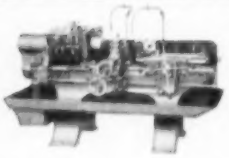
Medium Speed Boring with Tantung, V-R's Exclusive Cast Alloy

When surface speeds are too low for economical use of cemented carbides, and too high to permit use of High Speed Steel, V-R Tantung is the answer. This *exclusive V-R cast alloy bridges the gap between the maximum speeds possible with High Speed Steel, and the minimum speeds practical with cemented carbides.*

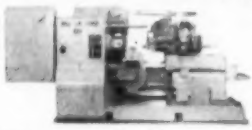
Example: Boring 2⅛" I.D. in Arma-steel while simultaneously turning the 8" O.D. as shown. The 215 RPM produces a 150 SFPM speed on the boring operation. This is too fast for High Speed Steel, too slow for carbide. Tantung gives maximum tool life with minimum downtime.

Your V-R Representative or Distributor is equipped to provide you complete information about the characteristics and applications of V-R Tantung Cast Alloy. Call him or write V-R.

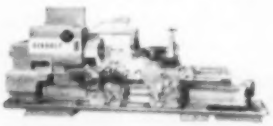
WARNER & SWASEY



BARDONS & OLIVER

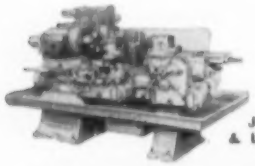


POTTER & JOHNSTON



GISHOLT

SOUTH BEND



JONES & LAMSON

V-R, manufacturer of both cemented carbides and Tantung cast alloy, offers you the cutting tool material best suited to your requirements. SEND FOR CATALOGS—and ask about VR-95 Ceramic for ultra high speed machining.

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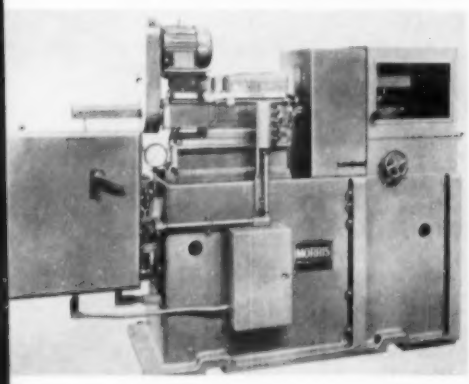
CT-628

TOOLS of today

Gun Drilling Machines

Standard automatic gun drilling machines, available in one-way and two-way models, have infinitely adjustable spindle speeds and feeds, adjustable automatic load control, and a coordinated high pressure coolant and chip removal system.

Equipped with either 6 in. or 9 in. stroke Air-Oil-Matic drill units, the machines are efficient for drilling deep holes $\frac{1}{8}$ in. diameter and up. They are also suitable for shallow holes where straightness, size and finish is critical; and for jobs where speed necessitates a high rate of metal removal, while finish is not critical. Many sizes of gun



drills, with variations in diameter and length, can be accommodated.

Spindle speeds up to 8000 rpm are obtained with a simple adjustment. Feeds up to 40 ipm are possible, with infinitely adjustable feed stroke. Speeds and feeds are independent of each other. The entire drilling unit is adjustable on a sliding base available for 6 or 9 in. movement.

Adjustable load control senses conditions that might endanger operation, thus protects machine against breakage of gun drills or workpieces. The control automatically detects dull or chipped drills, hard spots in the material, or insufficient coolant, in which case it immediately reverses the quill.

In order to make possible coolant pressures up to 1000 psi., the standard machine is equipped with a coordinated system consisting of a rear spindle coolant inductor, high pressure pump and gage, and filters. The coolant shuts off automatically on return stroke, and can be switched off, together with the spindle motor, to permit accessibility for setup. The 12-in. wide chip disposal trough is located immediately behind the bushing.

Main mounting of the gun drilling machine is a cast iron base with a 3-in. wide trough completely around the unit and fixture areas. The fixture shown is for drilling cylindrical parts. It has V-block holding devices which may be interchanged to accommodate 21 different size pieces.

The Morris Machine Tool Co., 933-37 Harriet St., Cincinnati 3, Ohio.

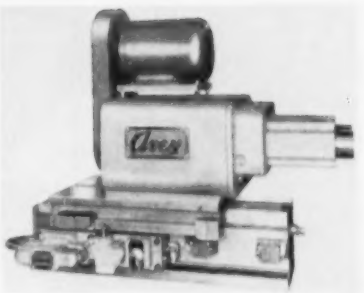
T-8-1

Machine Head

A building-block unit, designated the No. 4 Hydro-Way, is designed for heavy duty drilling, reaming, spotfacing, boring and counterboring, milling, and chamfering.

It has 5 to 20 hp, 12,000 lb maximum thrust, nonmetallic ways, hydraulic control panel which simplifies piping, and standard electrical components.

The machine provides positive depth control; adjustable coarse, fine and jump feeds; 12-inch travel; simple cutting tool change because of long stroke;



separate pump and tank units to permit additional hydraulic components from one central system.

The Hydro-Way unit may be mounted horizontally, vertically, or on an angle. Heads are provided to suit the individual job.

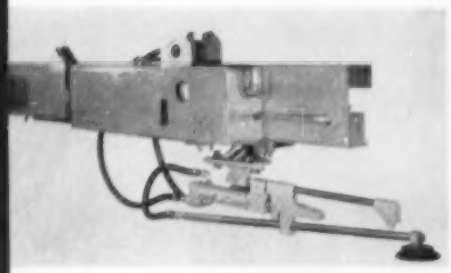
Avey Div., The Motch & Merryweather Co., Box 625, Cincinnati 1, Ohio.

T-8-2

Press Unloader

Automatic handling of sheet metal parts in stamping presses, as well as parts in plastic molding machines is possible with this press unloader unit. The gripping mechanism, called the Vac-Hand, can be mounted on standard PAS straight-line press unloaders. It has a rubber suction cup on the end of an adjustable rod. Vacuum pressure is induced into the cup for securing a part, and is released to unload the part. The adjustable rod is pivot-mounted and is advanced and retracted by an air cylinder control. The unit operates on 45-psi line pressure.

Because of the flexible rubber cup design, panels or moldings are not marred. The cup automatically conforms to both flat and curved surfaces. A single Vac-Hand unit will handle a



wide variety of part shapes and sizes. The suction cup can also be mounted in any desired radial location to suit a wide range of unloading requirements.

The new Vac-Hand concept avoids the need for positive knockouts on blanking operations. It also permits the use of shorter stroke. The Vac-Hand unit is interchangeable with all types of standard PAS mechanical jaw assemblies.

Press Automation Systems, Inc., 25418 Ryan Rd., Center Line, Mich. **T-8-3**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Internal Contour Grinder

Semiautomatic internal cam form grinder incorporates cam and cam follower at both ends of the workhead. This prevents any twist or bind and insures smooth follower action.

When rotated by means of a ratchet mechanism through 360 deg, the cam which controls the grinding in-feed completes a cycle consisting of rapid in-feed for roughing, dwell for wheel dressing and a slow in-feed for finishing.

Sizing is accomplished through the use of a micrometer type wheel dresser which, when once positioned, enables each succeeding workpiece to be repetitively identical.

Table movement is energized by hand feed, using the capstan type hand wheel; power feed, through a gear

driven mechanism electromechanically controlled for the full table travel of 12 in.; or reciprocator mechaism where the stroke is adjustable from 0 to 3 in.

Workhead cams are easily changed thus enabling the grinding of many different internal forms.

Swing over the table is 10 in. and maximum table travel is nominally 12 in. The machine weighs approximately 2500 pounds.

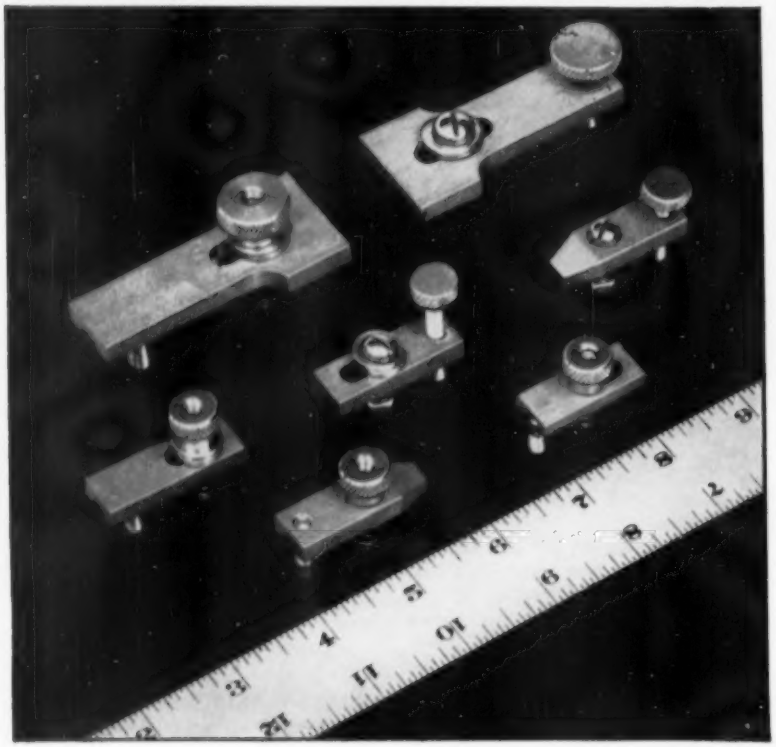
Parker-Majestic Inc., 147 Joseph Campau, Detroit 7, Mich. **T-8-4**

Hard-Facing Paste

An easy-to-apply hard-facing paste, called Hi-C 60, creates a deposit of high hardness that enables metal surfaces to withstand extreme conditions of abrasion or high temperature. The paste can be applied to any metal with a melting point higher than 1850 F. Thicknesses up to ¼ in. can normally be hard faced with Hi-C 60 using gas heating. For thicknesses greater than ¼ in., induction heating is recommended.

The paste, a permanent suspension of powdered hard-facing alloy in a

LODDING'S LITTLE FELLOWS



The Lodding line of stainless steel fixture components and clamp assemblies is complete and ready for you at your nearest Lodding warehouse. Carefully designed and made for essential holding in miniature operations . . .

- **Chisel Point Assembly . . .**
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-148

water-base solution, can be applied by spatula, brush, or by extrusion from a tube. Hardness ranges from 55 to 61 on the Rockwell C scale.

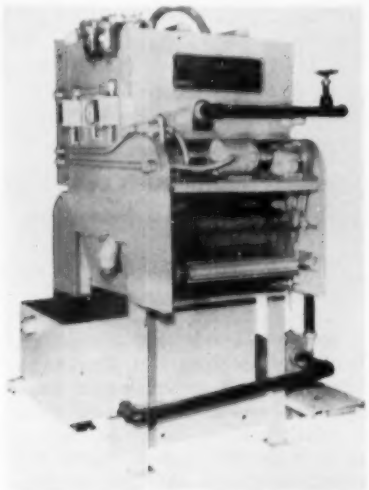
Western Carbide Corp., 6840 Vineland Ave., North Hollywood, Calif. **T-8-5**

Filter

The Hydromation Filter is a self-cleaning pressure filter using a flat sheet of filter media. This media may be any material supplied in rolls and having filtration properties.

The filter consists of one stationary and one movable compartment with a gasket seal between them, and an endless nylon mesh belt which carries the filter media. The unit is self-cleaning for flows of 10 to 3000 gpm.

During operation the two compartments are held closed by means of an air cylinder. Liquid is pumped to the top compartment, forced through the



media under pressure and discharged from the bottom compartment. As the filter collects material, the internal pressure rises. At a maximum pressure setting, the filter will go through an index cycle in which it automatically shuts off the filter pump, separates the compartments, moves the endless belt, closes the compartments, and resumes operation.

Hydromation Engineering Co., 19661 Schoolcraft, Detroit 23, Mich. **T-8-6**

Solid Carbide Burs

A countersink type solid carbide bur incorporates right-hand spiral flutes. Tests using this M-shape bur at 300 rpm to countersink $\frac{1}{4}$-in. diam holes in hardened die steel 62-63 R_c has shown it to provide positive shearing action and excellent chip rideout to produce a

PICTURE OF A TOOL ENGINEER LICKING A PROBLEM

A Soliloquy:

"Lucky I switched to 921-T on that Friday project, or I wouldn't be out here whipping this stream today. Funny, how that one material met all the problems; maximum stability, easy machinability, light weight — everything the old man wanted, and at less cost.

"I can see where 921-T could be used on every job on the board, and maybe a few that haven't been dreamed up yet. Come Monday, I'll recommend to Purchasing that we put in a stock of Pioneer 921-T and standardize on it for everything. It saws, taps, mills and welds so easily, a lot of material waste could be avoided. Boy . . . that's one for the suggestion box."

Pioneer 921-T cast aluminum tooling plate is a worry antidote for tool engineers. To get the complete story of its universal adaptability to form blocks, stretch form dies and jig components of all kinds, call your nearest Pioneer distributor for a copy of the new 921-T brochure.

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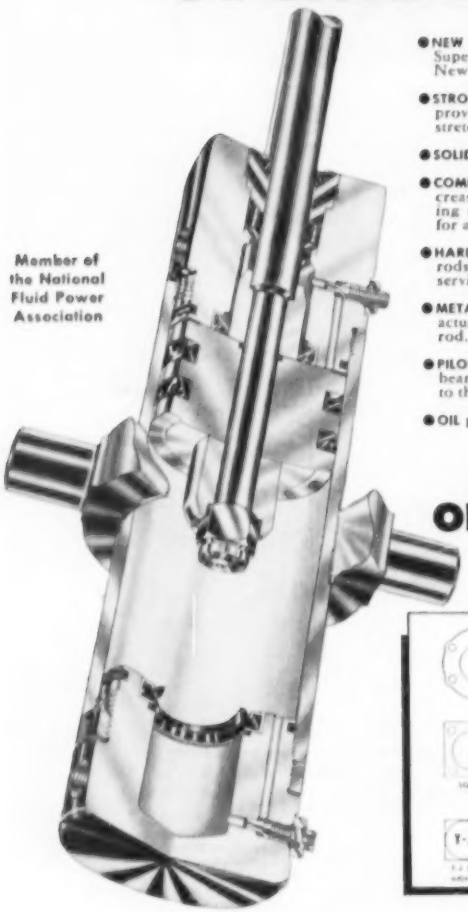

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- **SOLID STEEL HEADS** throughout the full line.
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- **METALLIC ROD SCRAPER**, not just a wiper, actually removes foreign matter from the rod.
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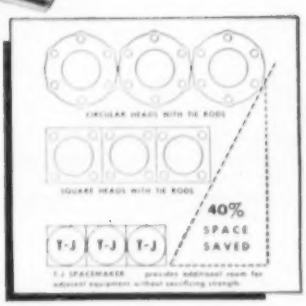
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.

DELIVERY OFF THE SHELF!



You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift jobs. Off-shelf delivery in 64,000 combinations!

NEW LITERATURE—Send today for new Catalog SM56 with complete engineering details on Spacemaker line. Write The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
VALVES · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHERS

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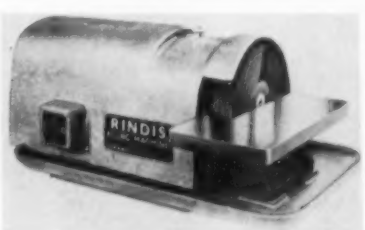
mirror-ground finish. In the test, chamfer was sunk to full diameter of tool, which showed no wear after counter-sinking 20 holes.

The M-141 RH spiral fluted bur worked well, regardless of whether counter-sinking was just a touch or to full diameter of tool.

Engineering Dept., The Atrax Co., Newington, Conn. **T-8-7**

Filing Machine

Continuous, powerful cutting and high-quality work on all filing jobs can be done by unskilled operators with the Rindis filing machine, designed for filing, trimming and deburring a variety of small components. Disks and rings with various teeth arrangements are provided for use at different speeds on



a wide variety of materials and finishes. The disks cut without heat, abrasive or coolant, while also retaining their shape without redressing. A table 12¼ x 4½ in., which can be locked at various angles to the disk, makes holding and feeding objects to the disk or ring easier for faster operation. The material removed contains no abrasive or foreign matter and may be reclaimed. In the case of precious metals, the filing process facilitates production of small particles or dust which are collected in the tray. It has a ½-hp continuously rated ball-bearing motor.

Newage Industries, Inc., Jenkintown, Pa. **T-8-8**

Nozzle Compound

A silicone - containing compound, called Linde 65 Sigma nozzle compound, is applied before welding and forms a thin protective coating over the bore and mouth of the nozzle. This invisible coating prevents molten metal from sticking to nozzle surfaces.

Under normal operating conditions, a thin coating of 65 compound will give nozzles 8-hr protection. However, where

the current level is high or unusual welding conditions exist, the compound should be applied every 4 hours or less to assure continued nozzle protection.

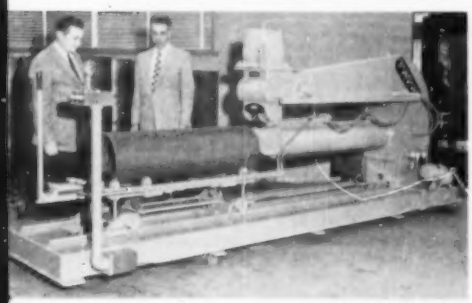
The ready-to-use compound is greaseless, odorless, and nontoxic and can be applied directly to the nozzle without any special preparations.

Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N.Y. **T-8-9**

Roll Planisher

This heavy duty roll planishing machine, designated Model R-47560, is designed to smooth a weld of substantial build-up in 10 seconds.

Automatic loading and unloading fea-



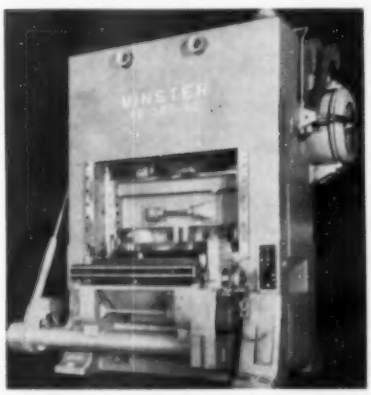
tures incorporated into the unit provide fast operation.

Airline Welding and Mfg., Inc., 785 N. Prairie Ave., Hawthorne, Calif. **T-8-10**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Press

This 300-ton Piece-Maker P2-300 two point, straight side press for automatic progressive production is a single geared center drive type press capable of operating in the range of 75 to 150 strokes per minute with a standard 3 in. stroke. It is available with bed widths of 66, 72 or 84 in. right to left and 48 in. front to back. Slide is 34 in. front to back.



Mounting of the steel herringbone main drive gear in the center of the two point, full eccentric crankshaft allows the range of speed. It also reduces torsion and equalizes power transmitted to the slide connections.

Standard single or double roll feeds are available to feed from either direction or front to back.

The illustrated unit has a single roll front to back feed driven from the crankshaft through spiral meter gears.

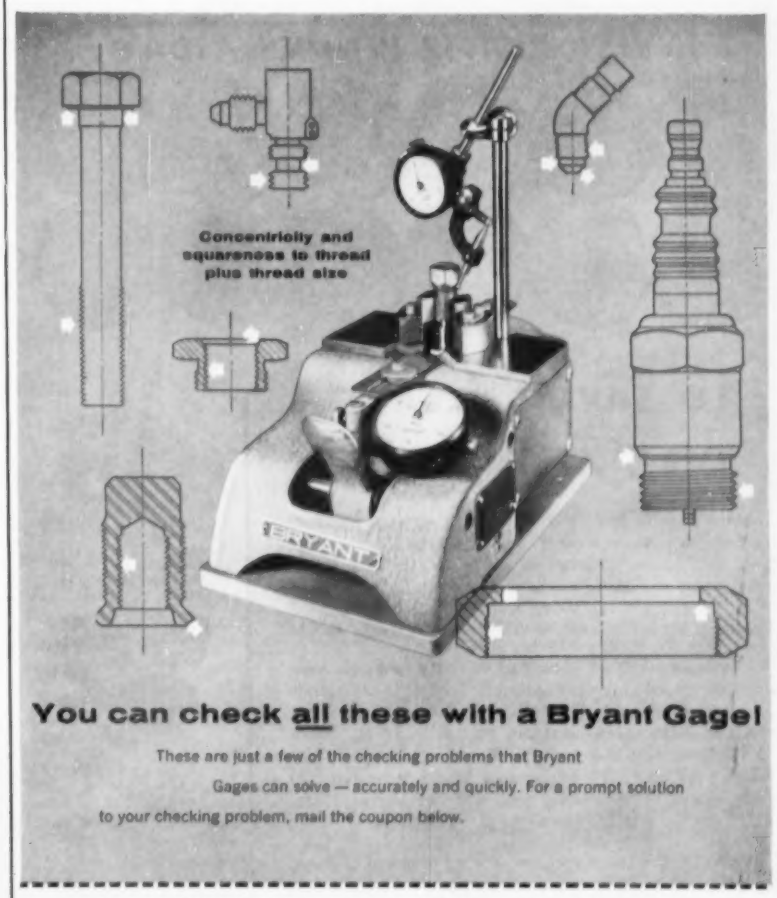
Operators station, drive and clutch controls are located on the press upright. Centralized press control cabinet is mounted off the press.

The Minster Machine Co., Minster, Ohio. **T-8-11**

Feeding Device

High-speed method for automatic elevating, orienting and feeding of parts to automated production lines uses a combination feeding unit that will handle parts that roll or slide. Although the equipment is custom-tailored to a specific job, it is assembled from standard components and may be adapted to any part feeding job.

In operation, parts are conveyor-fed or truck-dumped into the hopper section of the unit. From there, they are scooped onto slanted shelves for elevating and feeding to a distribution system. When elevated, properly-positioned parts roll through; improperly-positioned parts are chuted again to the hopper as they fall free on the



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These are just a few of the checking problems that Bryant Gages can solve — accurately and quickly. For a prompt solution to your checking problem, mail the coupon below.

Bryant Gage and Spindle Division P. O. Box 620-J Springfield, Vermont, U.S.A.

Gentlemen: ☐ I am enclosing a print of my part. Please send me a quotation. ☐ Please send literature and prices on the complete line of Bryant Gages. ☐ Please have Bryant representative call.

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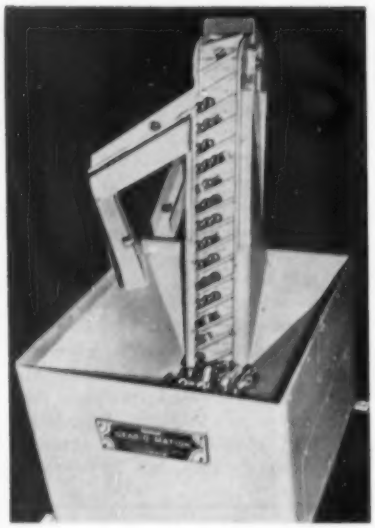


back side. Before passing into the main distribution system, parts from the elevator are again checked as to orientation by being passed over a narrowed track. If not properly in line they drop off and are returned to the hopper.

The unit has a ½-hp motor, and variable-speed transmission is enclosed. Elevator height, capacity and feeding take-off rate are adjustable to suit the application.

Gear-O-Mation Div., Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich. **T-8-12**

Frame Balancing Machines

Beko Model F simplified frame balancing machines have weight capacities, in various models, ranging from ½ oz to 150 lb.

Magnitudes of unbalance are positively indicated by a large, easy-to-read meter, calibrated directly in terms of the unbalance correction procedure selected. Angular positions are accurately pointed out by a stroboscopic lamp, and are readable either at a location to add weight or to remove weight, depending upon the user's correction procedure.

Working areas and controls are designed for optimum operator convenience.

Macdell Corp., Sales Div., Balance Engineering Co., 856 W. Lake St., Chicago 7, Ill. **T-8-13**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Thread Gages

Fast accurate checking of external threads is possible with this measuring instrument called the Threadometer No. 310. It measures and checks pitch diameter of the thread taking into consideration influence of errors both in pitch and thread angle. Measurement is made in the same way as with a limit roll

Model 312 left, and 310, right.

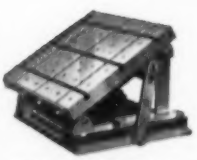
INVEST JUST 12 PENNIES A DAY

TO SAVE DOLLARS THE *Robbins* WAY

Robbins angular tooling equipment often pays for itself the first few times you use it . . . but let's be conservative. Let's talk about writing off the cost over ten years. (About half the useful life of a "Magna-Sine!") Written off in this manner, the Model A-5 Magna-Sine illustrated represents an investment of around twelve cents a day!

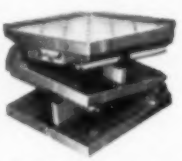
This equipment saves dollars of valuable toolroom time on every job. Set-ups that require *hours* by other methods take just *minutes* the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

This simple, fast, sure method sets up any angle, single or compound, right or left hand, without V-blocks, angle plates or complicated "build-ups." Complete range of models and sizes puts Robbins precision equipment within the reach of every shop. Write now for literature.



HEAVY DUTY SINE PLATE FOR MACHINING

"MAGNA-SINE" WITH MAGNETIC TABLE



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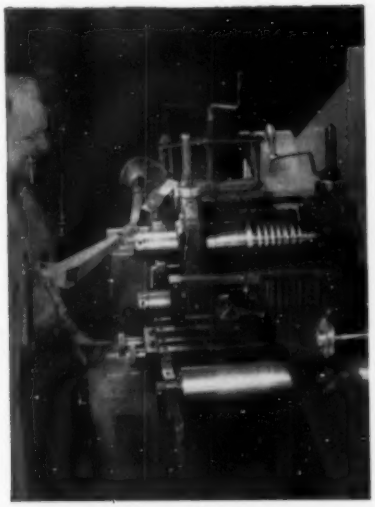


YODER SLITTERS Supply Varied Strip Widths for Tinnerman *Speed Nuts*®

Tinnerman Products, Inc., Cleveland, Ohio, produces more than 10,000 different shapes and sizes of "SPEED NUT" brand fasteners for industry . . . many of them to special specifications.

To do this, Tinnerman uses slit steel strands ranging in width from ⅛" to 7½". To carry an inventory of the many strip widths required to meet normal and unusual demands would be almost impossible.

Tinnerman overcomes these inventory and supply problems by doing their own slitting on two Yoder slitters. This enables them to supply the plant with any strip size required from a relatively small inventory of 6" and 9" width purchased coils. In slitting narrow strands, such as these from small coils, a Yoder slitter may be profitable on a production as low as 25 tons per month.

Here is a fine example of how a small investment in Yoder slitting equipment greatly simplifies and speeds production while effecting important operating economies.

The saving made in time alone, reflects in better customer service through faster completion and delivery of finished products.

If your steel strip or sheet slitting requirements are as low as 100 tons per month or even less, a medium size Yoder slitter can be a very profitable investment for you. The Yoder line includes units of every size and capacity . . . of the most advanced engineering design. Send for the Yoder Slitter Book —a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. Write to:

THE YODER COMPANY
5525 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING **ROTARY SLITTING LINES**

INDICATE A-8-153-1

thread snap gage, but the instrument can be quickly set to different diameters and thread limits.

A second instrument, Threadometer No. 312, is designed to check taps and other components with external cylindrical precision threads. Its construction allows measurement of taps with odd or even number of flutes. Pitch diameter is checked and measured and eventual errors in pitch and thread angle do not affect measurement.

In both instruments, measuring pressure is adjustable between approximately 1 and 3 kg.

Made by C. E. Johansson Gage Co., Sweden. Distributed by C. E. Johansson Gage Co., 10641 Haggerty Ave., Dearborn, Mich. **T-8-14**

Threading

This universal threading holder incorpates an interchangeable, high-speed threading blade which has two cutting

edges. This design permits reverse of the lathe to cut a thread without danger of hitting shoulders.

Aloris Tool Co., 131-37 Sanford Ave., Flushing 55, N. Y. **T-8-15**

Lapping Machine

The Lap-King precision lapping machine is a 15 x 14½ in., bench type portable unit capable of producing lapped surfaces accurate to 11.6 millionths of an inch. Due to simplicity

• *A good chair is like a good wife...if you choose with care, it will look after your comfort and aid you in your work for a long time to come*

Cramer CHAIRS ARE

GOOD CHAIRS

Scientifically planned to aid YOU in your work . . . designed to support you comfortably whether you're chewing your pencil or bent over hard at work . . . engineered from the quality materials YOU would recommend, with independently adjustable seat, back and footring to conform to your physique . . . and with removable, replaceable covers in a wide range of fabrics and colors to match YOUR decorating plan.

Pictured, Cramer Hi-Model 4D-22T with forward-tilt seat; others available. All are low-gravity balanced for safe use on casters if desired.

LIKE MORE INFORMATION?

Cramer Posture Chair Co., Inc., Dept. TE-87
1205 Charlotte, Kansas City 6, Mo.
Please send me complete facts on the Cramer Hi-Model chairs designed for working architects and engineers.

Name _____
Firm _____
Address _____

INDICATE A-8-153-2

of procedure, any mechanic or machinist can operate the unit at full efficiency. Quality control is easily maintained because it is designed to relap its own plates, one against the other, after a normal job run, assuring consistent optically flat lapping plates for automatic accuracy of lapped work. An hour meter records exact amount of lapping time on each plate. An automatic timer, operating in a one-hour cycle, allows job time control.

Byron Jackson Pumps, Inc., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. **T-8-16**

Optical Measuring Instruments

These instruments, called coordinate cathetometers, make both a horizontal and vertical measurement in a vertical plane at one setting. Because the object being measured does not have to be rotated, inspection time is minimized and there are no resetting errors.

The device consists of a microscope or telemicroscope mounted on a carriage which moves up and down on a vertical bar. This assembly moves horizontally on ways. Fine motion adjustment is provided by precision micrometer screws.

The coordinate cathetometers are useful for precision nondestructive measurements on large objects, or on objects or points in recessed, remote or inaccessible locations. There is no contact, distortion or pressure applied to the object when making a setting. Co-

ordinate ranges from 2 x 2 up to 42 x 24 in. are available in both the English and metric systems.

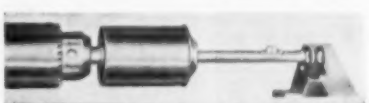
Three representative examples of the coordinate cathetometer line are: Model M1238-1818, which has a range of 18 x 18 in. and a working distance of 9 in. to infinity. It reads to 0.001 in. up to 24 in. working distance, and has a protractor occular that reads to 3 min of arc; Model M1236-46, which has a horizontal range of 6 in. and a vertical range of 4 in. It reads to 0.0001 in. and has a working distance of 5 in. to infinity; Model M1236-22, which has a range of 2 x 2 in., a working distance of 5 in. to infinity, and reads to 0.0001 in.

Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill. **T-8-17**

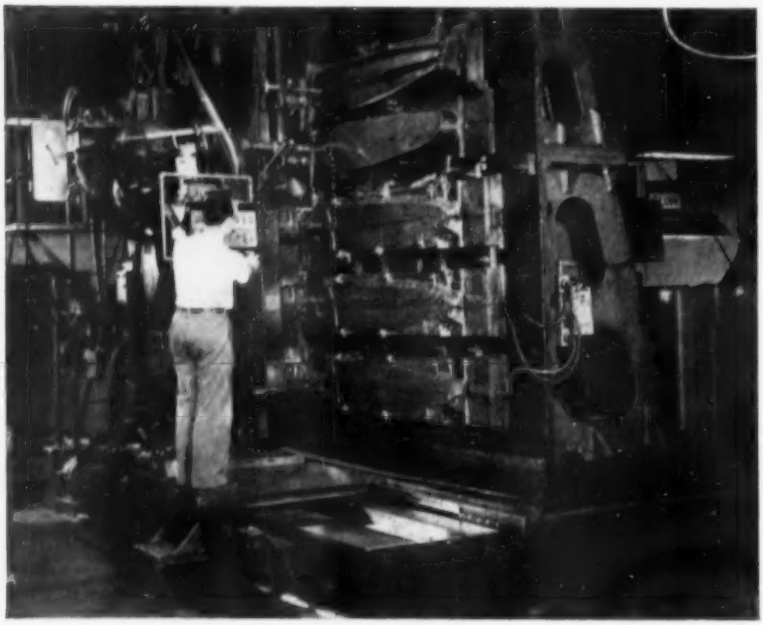
Deburring Tool

The automatically self-actuated Noburmatic H tool, which functions with a positive mechanical action, deburrs and chamfers both front and back sides of holes. It will finish both faces from a single entry without need for reversing the part, and is particularly useful for holes drilled into a blind cavity where the back face is not openly exposed, or for holes drilled through two or more parallel walls.

Its action does not depend on any



Walker Does it Again -



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

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spring setting; thus, performance is consistent during volume production. It is equally adaptable to manual usage in conventional drill presses and in sequence with drilling operations. An approximate 45-deg chamfer angle is produced.

The tool is available for whole sizes ranging from ¼ to ¾ in. and for working depth from 1½ to 3¼ in.

Nobur Mfg. Co., 6860 Farmdale Ave., North Hollywood, Calif. **T-8-18**

Tapping and Drilling Tool

Multiple and single-spindle tapping and drilling operations can be accomplished on this combination machine which is air controlled for up to 50 semiautomatic or automatic cycles per minute.

Air-powered feed on the spindle provides excellent thrust condition and feed control for drilling operations, as well as closely-controlled lineal thrust to allow taps to lead themselves and duplicate their assigned class of thread. Tap breakage is minimized.

Because of a direct spindle-reversing feature there is no need for separate

single or multiple spindle clutch type tapping heads. Taps fit directly into collets or chucks.

Instant reversing motor is automatically controlled by air feed to properly synchronize direction of spindle rotation with direction of spindle. Only spindle-depth adjustment is required.

Change from tapping operation to drilling is initiated by a simple flick of a switch and belt speed changes.

Fixtures and holding devices can serve for both operations.

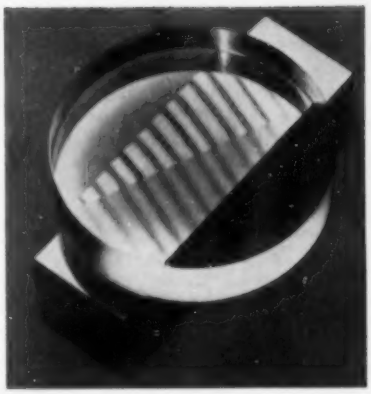
Motor controls allow machine to be used for tapping left-hand threads, and to handle thread chasing. Tool capacities in mild steel are four ⅜ in., six or more 10-32, or a single ⅝ in. for tapping, and four 5/16 in., six or more 3/16 in., or a single ⅝ in. for drilling. The machine drills to center of 15-in. circle. Spindle travel is 4 in. It incorporates No. 33 chuck taper and No. 2 Morse taper socket type spindles. Bench or floor models are available with from one to 8 heads per unit. Separate heads without columns or worktables also available.

Boice-Crane Co., 934 W. Central Ave., Toledo 6, Ohio. **T-8-19**

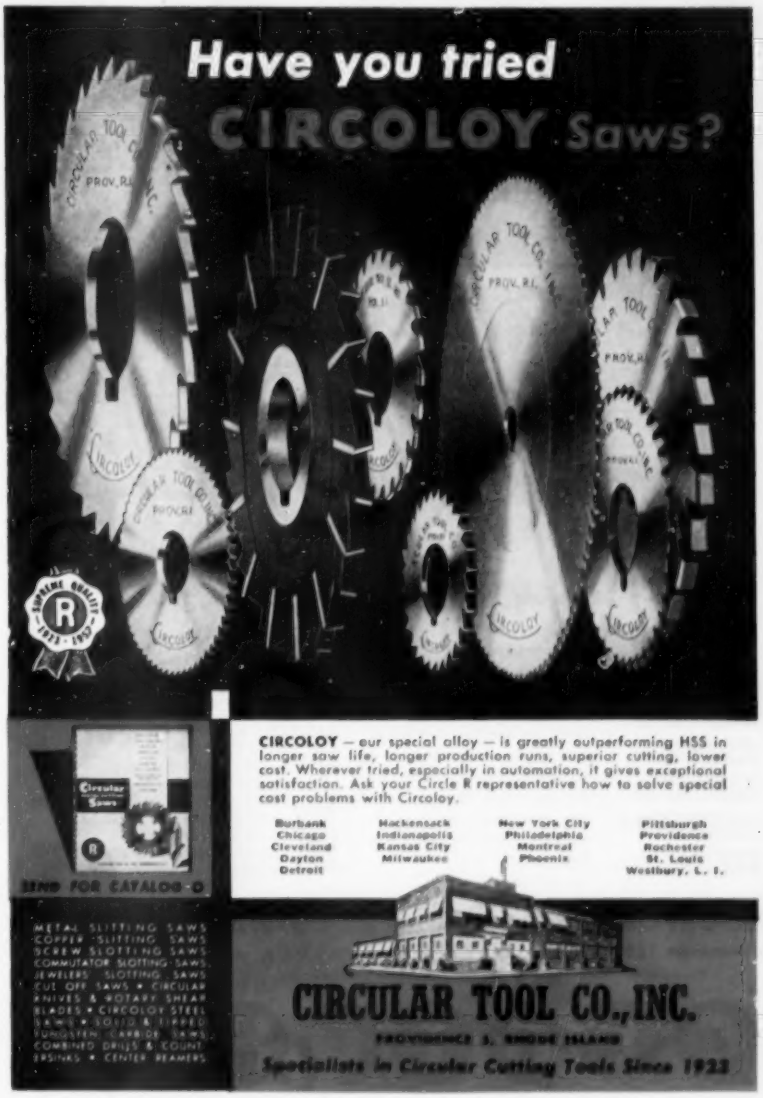
Coated Optical Flats

These Micro-Koted Flats are fused quartz optical flats which have been coated with a durable, hard transparent metallic material that will not peel or rub off.

The flats provide a high degree of



accuracy. Width of the dark fringe is equivalent to about 0.000001 in. of height. Fringe boundaries are clearly defined and fuzzy borders are mini-



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mized. They have good contrast for greater ease in observing fringes especially on highly reflective work. The coated flats also offer unusually long wear life.

In the illustration an optical flat is being used to measure flatness of an amplifying gage anvil. Upper lift side of the flat has been Micro-Koted while the lower right hand side is untreated.

The Van Keuren Co., 176 Waltham St., Watertown, Mass. **T-8-20**

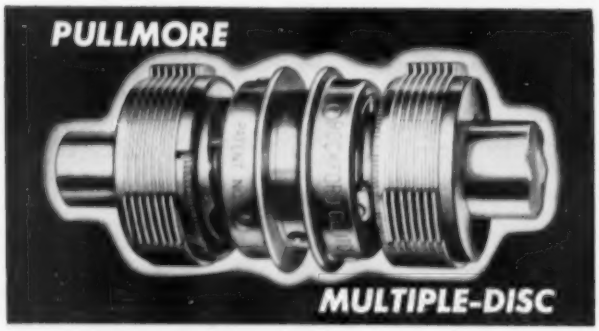
Drilling Machine

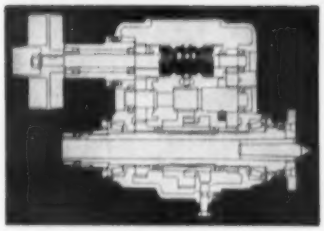
This Adams upright drilling machine has 8 geared speeds, standard 50 to 950 rpm with optional speeds available. It also has 8 feeds, standard, per revolution of spindle of 0.002 to 0.021 in.

Design features include extra room under the spindle, extra swing, and a large table that makes possible doing a job that usually cannot be done on a machine of its size without change in setup. Spindle travel is 10 in.; head travel 10 in., and table travel 18 in. The coolant system consists of a motor-driven centrifugal pump integral with ¼ hp, totally enclosed, permanently lubricated motor. The coolant tank is 5-gal capacity.

Distributed by Index Machine Co., 543 North Mechanic St., Jackson, Mich. **T-8-21**

ROCKFORD





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CLUTCHES

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Boring-Spot Facing Tools

Combined boring and spot facing tools are available with throw-away blanks for both operations. The boring blank is micro-adjustable to provide a positive adjustment for diameter. Dial head of the adjustment screw is calibrated so that every graduation is equal to 0.001 in. on diameter.

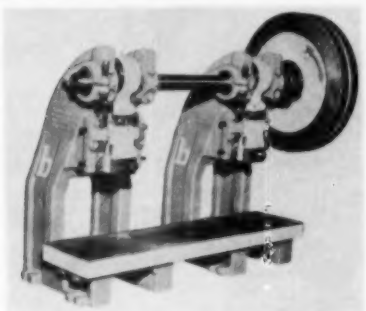
Once adjusted, there is usually no

need for further resetting of the tool. When one edge is dulled, the blank is indexed to a new cutting edge. Correct location is automatic. When all edges have been used, the blank is replaced with a new blank.

Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich. **T-8-22**

Multiple-Ram Press Brake

In this multiple-ram setup, two 5-ton fixed-bed gap-frame press brakes are operated in tandem from a single crankshaft common to both presses. The two press frames are separated by 18½ in. between ram center lines and are held in alignment by a single bolster plate measuring 37 in. long by 8 in. wide and



1½ in. thick. The crank has a stroke of 1⅛ in. and operates at 230 strokes per minute. Total tonnage developed is 10 tons.

With this type of construction any normal separation of press frames is practical.

Benchmaster Mfg. Co., 1835 W. Rosecrans, Gardena, Calif. **T-8-23**

Spring Coilers

Universal spring coiling machines are designed for accurate high-speed production. For accuracy of measurement, feed is determined by cams which raise and lower the feed rolls. Special holding action allows more than one revolution of the feed roll per spring and provides a wide feed range capacity. Wire feed does not vary with increase in speed. Feed ranges beyond the standard limitations are accomplished by a feed cycling arrangement combined with continuous coiling and manual cutter control.

In the escapement type feed, nothing starts and stops except the wire itself; all other stopping, starting and reciprocating motions in the feed mechanism are eliminated, so inertia is minimized.

Camming of the springs is accomplished through linkages designed for precision movement of coiling points

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Why worry about where to find competent designers and engineers of dies, fixtures, tools and gages.

Pioneer has them for you.

Our highly skilled tool designers and engineers are the permanent solution to engineering overloads in many tool and process engineering departments like your own.

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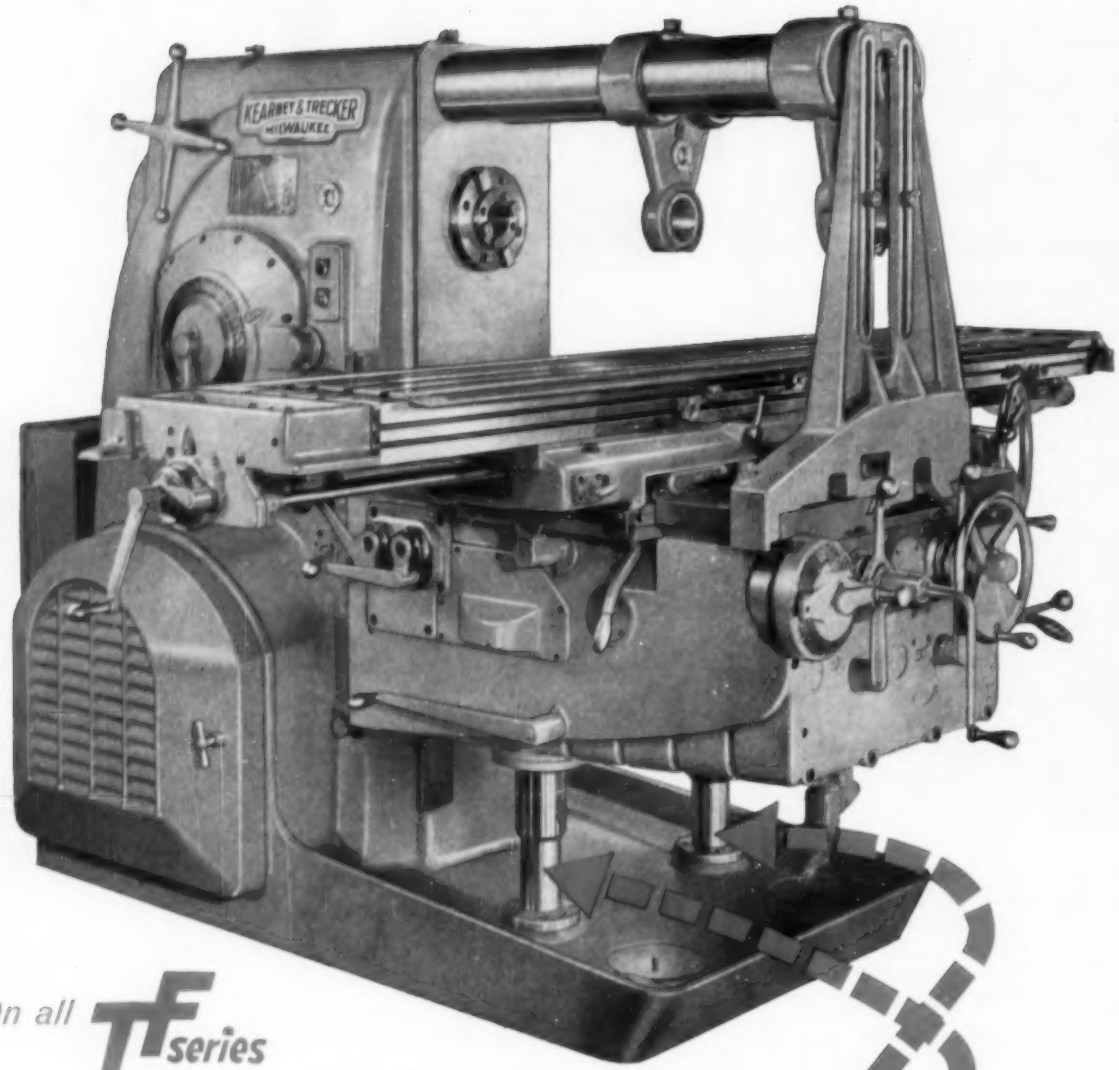

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Exclusive

KEARNEY & TRECKER MILWAUKEE twin elevating screws

INCREASE ACCURACY 3 TIMES

over single screw designs

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of
Precision and Production Machine Tools Since 1898

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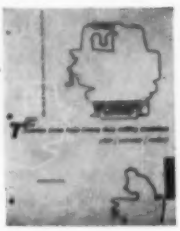

We'd like to show you. Write for BulletinTF-57 on your letterhead.
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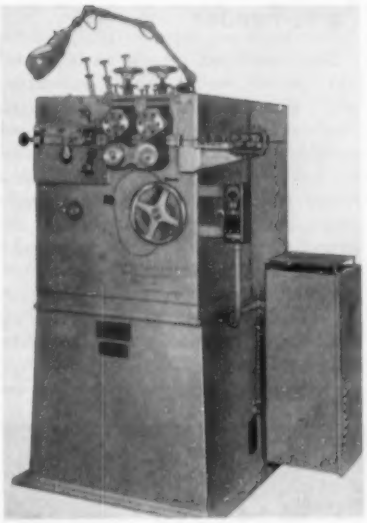


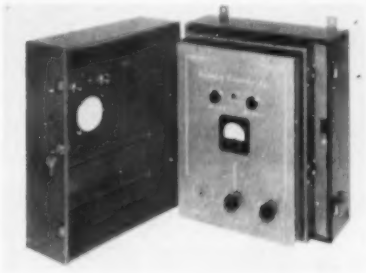
and pitch tools. Lateral position of the cutter tool is rigidly maintained by the three-point suspension lock of the adjusting lever. Spring production is readily regulated by a-c d-c drive, with dialed speeds and push-button starts, stop and jog control.

Sleeper & Hartley, Inc., Worcester, Mass. **T-8-24**

Safety Control

This electronic safety control sets up a capacitance field around a danger area so if an operator or his hand enter this area an electrical signal is sent to the machine braking mechanism.

Size and shape of the safety field are determined by the positioning of the



sensing element and control adjustments. The machine will not run with a person in the field.

Failure of any electronic component causes the machine to stop. Tubes are readily accessible for checking, and the inner chassis is removable. Cabinet is shock-mounted and gasketed, and has a lock and key.

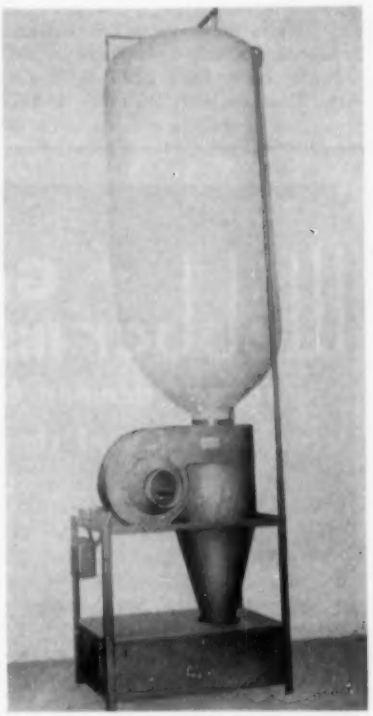
Sensing elements of differing sizes and shapes may be used to protect specific areas.

Security Controls, Inc., 257 Franklin St., Buffalo 2, N. Y. **T-8-25**

Dust Collector

An air recirculating dust collector, designated No. 20C30, requires no outside exhaust outlet. It has an air capacity of 2405 cfm and a dust storage capacity of 6 cu ft.

Dust particles are separated from the air within the unit by a cyclone separa-



tor, and the dust is precipitated into a bin located in the base. Air is exhausted into a 3 x 7½-ft bag, which filters out the finest dust particles and releases dustfree air into the work area. The bag is cleaned by shaking.

Aget Mfg. Co., Adrian, Mich. **T-8-26**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hand Torque Screwdriver

Particularly suitable for assembly of small parts, this hand torque screwdriver enables operator to run and precisely torque small nuts, screws and other threaded fasteners quickly and accurately. There is no risk of stripping miniature threads or fracturing brittle materials.

The tool is light and well balanced, has visual adjustments in increments of ¼ in-lb, and is continuously adjustable from 0 to 8 in-lb. It is simple to operate and its push action minimizes operator influence. It is easily adjusted

for different torque settings, and has ¼ in. female hexagon drive to receive special bits and sockets. It will not lose accuracy with constant use.

Swift Tools Inc., 3201 S. Prairie Ave., Sioux Falls, S. D. **T-8-27**

Parts-Feeder

High-speed multitrack parts feeder and counter, called the Hoppermatic, will handle a variety of small parts. The standard machine can be changed over from one size or shape part to another in a few minutes. The standard Hoppermatic is equipped with a single adjustable track. Multiple track delivery of 2, 3, 4, or 5 tracks can be provided.

Multiple tracks are used either to supply parts to several stations in an assembly or machining operation or to provide a greater rate of feed in a counting or packaging operation.

Hopper of the units consists of a cast drum with cast-in pockets. As the drum rotates, the pockets collect a quantity of parts, carrying them up to the orienting chute.

A stationary retainer plate gradually closes the pocket as the hopper revolves, capturing the collected parts. At the peak of the turn, parts reach the end of the retaining plate and the product flows into the orienting chute and down the track. Parts not properly oriented are rejected back into the drum. At the end of the track is an adjustable release mechanism that can be set to release one or more parts at a time.

The unit illustrated is adapted to feed four rows of #12 x 20/32 in. long studs. Four studs—one from each track—are released each time the solenoid-controlled release mechanism is actuated.

U. S. Engineering Co., 40-24 22nd St., Long Island, N. Y. **T-8-28**

Webber Gage Block INSPECTION SERVICE

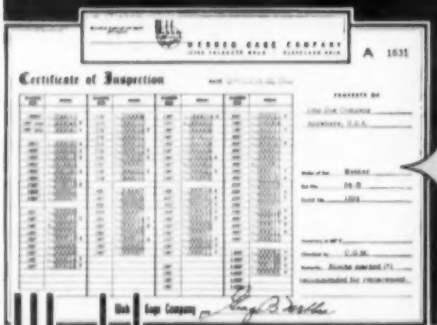
Today's demand for production accuracy requires frequent checking of your gage blocks

Webber Gage Company, largest exclusive manufacturer of precision gage blocks, makes its own laboratory inspection facilities available to all users of gage blocks, regardless of make or model. The service is inexpensive. Your gage blocks are returned to you in less than one week, with a certificate of inspection showing the present size of each block in comparison with master blocks certified by the U. S. Bureau of Standards.

In addition all nicks and burrs are removed.

If you wish, replacement of any worn or damaged blocks can be made either with standard steel or with Webber's famous Croblox (solid chrome carbide). When you select Croblox you have assurance of accuracy for many years to come, as these super-hard blocks will last up to 50 times longer than the best standard steel.

WEBBER INSPECTION SERVICE WILL SAVE YOU MONEY!



You get this certificate of inspection showing the dimensions of every gage block in your set.

The cost of all this for a full 84 block set is only... $18

Smaller sets in proportion.

Webber GAGE CO. 12908 Triskett Road, Cleveland 11, Ohio

LARGEST EXCLUSIVE MANUFACTURERS OF PRECISION GAGE BLOCKS

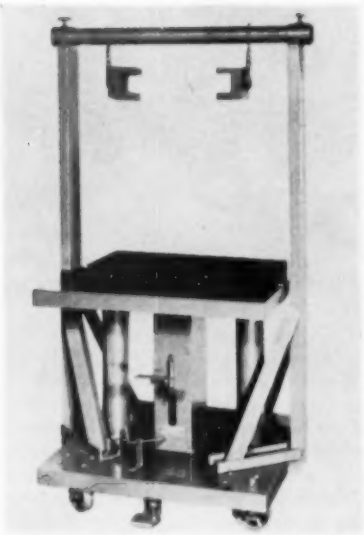
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-160

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Die Separator

Demountable die separator, for use in conjunction with the lift tables, has heavy-duty all steel welded construction, is quickly and easily secured and mounted to the lift and table base. Cross bar of rolled steel tube is equipped with two clamps which are movable on the cross bar enabling adjustment to fit any width die set. Clamps are capable of suspending 2000 lb.

The die separator when mounted on



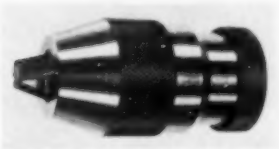
the lift table has a height of 62 in. from floor to bottom of cross bar. A width of 30¾ in. and a table clearance of 14 in. when table is raised to its highest position.

Dept. DS, Lexco Engineering & Mfg. Corp., P. O. Box 161, Colmar, Pa.

T-8-29

Drill Chuck

Each part of this Swedish precision drill chuck, called the Rapid, is hardened and precision ground. It is an automatic tightening chuck, without key.



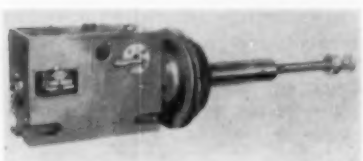
There is no slipping and chewing of the drill shank.

Ball bearing construction makes opening the chuck after operation easy even after heavy cutting. Spindle and ball bearings are protected against dirt.

Karl A. Neise, 404 Fourth Ave., New York 16, N. Y. **T-8-30**

Boring Head

Designed for installations where space is limited, the precision borer, called Hydro-Borer Model S-6 has overall dimensions of 29½ x 6¾ x 3¾ in. It



can be easily mounted on workholding fixtures or assembly jigs.

A principle of positive feed by oil displacement is used on the unit. Rate of feed is variable in two ranges: from 0.002 to 0.004 in. and from 0.0035 to 0.007 in.

Spindle diameter is 1¼ in. with a #2 Morse taper. The taper can be supplied either concentric or eccentric. Eccentric taper permits increasing bore diameter a total of 0.014 in increments of 0.001 without resetting the tool bit.

The S-6 is capable of boring within a tolerance of 0.0003 in. and producing a finish of 30 microinches or better.

Greenlee Bros. & Co., Rockford, Ill.

T-8-31

Carbide-to-Steel Bond

Using a material called Weldalloy, carbide can be joined to steel in a union strong enough to stand up under any punchpress production without separation.

Weldalloy is made in two series. Weldalloy A is used as an intermediate joining material between carbide and steel, forming an excellent cushion between the two. Hardness can be varied from 20 to 50 R_C. Heat treatment can be applied to air hardening steel after joining with carbide so that entire piece may be brought to any desired hardness.

Weldalloy B alloys are used as casing materials to reinforce carbide inserts.

"Ten Times More Hits

Since we standardized on LAMINA GUIDE PINS and BUSHINGS"

"We have increased our hits between grinds on high speed precision dies up to ten times more than we previously had since we standardized on Lamina Guide Pins and Bronze-Plated Bushings." And that, as quoted from a user letter, is just one reason why it pays to specify Lamina as your standard, too.

You'll find, in addition, that Lamina Guide Pins and Bushings prolong die life, improve quality control, reduce downtime and cut costs . . . because the special tool steel of Lamina Guide Pins is uniformly heat treated, spray quenched and precision ground to resist wear, bending, "mushrooming" . . . and because Lamina Bronze-Plated Wring-Fit Bushings are strain relieved and pre-finished on the I.D. to assure distortion-free smooth operation, proper lubrication, positive alignment. What's more, there's a Lamina Guide Pin and Bushing for every die set need.

SPECIAL PINS AND BRONZE-PLATED BUSHINGS for any application . . . tailored to your requirements. Send prints for prompt quotation.

WRITE NOW FOR NEW 40-PAGE CATALOG SHOWING ENTIRE LINE!

LONG SHOULDER TYPE—Large clamp. Bearing surface contains pin during entire stroke. 2" to 3" pin diameter.

SHORT SHOULDER TYPE—For die space, more bearing space within die area, 7 lengths, pin sizes ⅝" to 2".

NUT TYPE—For wide range of general purpose requirements. Available in 5 sizes, 1" to 2" pin diameters.

REMOVABLE TYPE PIN—Designed for use wherever pin removal is necessary. Offered in diameters from 1" to 3".

Lamina DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-161

Readily machinable, their hardness range is 80 to 100 R_C, as molded.

The Weldalloy process can be applied to any grade of carbide.

Welded Carbide Tool Co., Inc., 62-68 Colfax Ave., Clifton, N. J. **T-8-32**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Portable Air Tool

Designed for fast automatic fastening, the Cyclamatic has only two internal moving parts. Because of its construction, there is no need for springs; the piston is automatically returned by air without loss of pressure to the atmosphere. The tool can be fired at the rate of 350 cycles per minute.

The Cyclamatic drives Cal-Nails up to 2-in. size with a single stroke in hard-

woods, and it can be used with Calwire industrial staples up to a 14-ga (1⅝ in.).

California Wire Products Co., Inc., Visalia, Calif. **T-8-33**

Hydraulic Sump Filter

One-piece hydraulic sump filter is made of sintered powdered metal which gives controlled depth of filtration while

providing large filtering area and high flow capacity with negligible pressure drop.

There are 6 ranges of flow capacity from ¾ through 1½ in. pipeline sizes.

Arrow Tools Inc., 1947 S. Kostner Ave., Chicago 23, Ill. **T-8-34**

Press Unloading Equipment

Improved jaw cylinder and jaw design provide this press unloading equipment with an unusually strong gripping force.

Gripping area in the jaw itself is small to give maximum gripping force, and tough steel inserts (self-clinging when the jaw is closed) are easily replaced without cotter key or solder.

A Sahlin type rod end piece on the piston rod allows the jaw to float independently of the cylinder, avoiding tendency to bind and back-pin failure. It also lessens wear on bushings when the jaw is extended. Back cushion of the cylinder can be removed or replaced

RING PUNCHES AND DIES

STANDARDS

COMPLETELY INTERCHANGEABLE
SHIPMENTS FROM STOCK
CHOICE OF STEELS
HIGH QUALITY
LONG LIFE
LOW COST

NEW!

PUNCH & DIE RETAINERS

Tough alloy retainers accurately machined for Ring Punches and Dies. Ease of mounting saves time and money.

SPECIALS

Send prints or sketches for quotation on your requirements. Prompt deliveries—reasonable prices.

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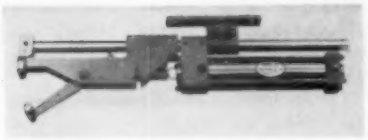
RING PUNCH & DIE, INC.

FENTON PLACE JAMESTOWN, NEW YORK

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-162



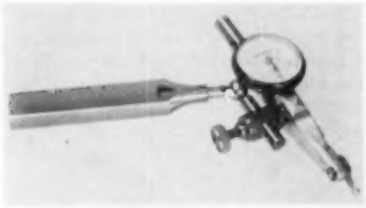
quickly. All parts are tooled to insure interchangeability, and the fasteners used throughout are standard tool-crib items.

Sahlin Engineering Co., Inc., Birmingham, Mich. **T-8-35**

Dial Test Indicator

Verdict Model C dial test indicator has a ¼ in. spigot as well as a side clamping holder which permit unlimited positioning of the instrument.

The tool is designed with a rotatable bezel, reversing lever and ratchet con-



tact point. The 1 in. dial, clearly calibrated for easy reading in 0.001 in. graduations, has a 0.030 in. range.

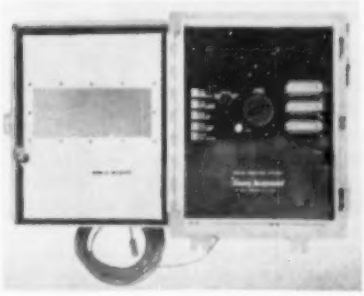
Distributed by Transocean Trading Co., 6453 Santa Monica Blvd., Los Angeles 38, Calif. **T-8-36**

Machine Control Unit

A fully-contained electronic package control was developed for use on shears and other machines that cut and fabricate sheets of metal, plastic, fiber and other materials.

Originally designed for controlling the operation of a large shear in a sheet metal plant, the unit is adaptable to controlling the operation of many types of machines and the working of varied materials.

Designated as a Sensory Shear Director, it has electronic touch sensors and a photosensor, combining to control the shear for insuring correct dimensions,



HOW TO GET ALL THE ADVANTAGES FROM THROWAWAY TOOLING

Many plants lose a good part of the potential benefit in their throwaway tooling programs. But the lost advantages can be regained by using MicroDex inserts. They are processed by a new technique to give you a 25% gain — or more — in throwaway tooling efficiency.

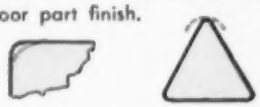
BELOW ARE THE FEATURES REQUIRED IN AN INSERT FOR PEAK THROWAWAY TOOLING PERFORMANCE:

DIMENSIONAL ACCURACY — You want, of course, to be able to index or replace an insert and get the machine under way again without resetting the tool or taking trial cuts. So, dimensional requirements must be far more rigid than formerly thought necessary. (On turning, for example, an insert error is doubled on the part.)

Corner angles must be right — Radii must be accurate and equal — Turnover inserts must have square sides

Valenite MICRODEX inserts are ground by an exclusive new method to give you the most accurate inserts obtainable.

TRUE RADIUS TANGENCY — Corner radii must be truly tangent to the sides. If not, the insert will cut on a sharp point. This reduces insert wear life and makes for a poor part finish.



Valenite MICRODEX corner radii are always perfectly tangent to give you better throwaway service.

FINE SURFACE FINISH – A good micro finish on the insert is essential if you want smooth cutting, good part finish and long insert life.

Compare MICRODEX! Fine finish is a bonus advantage of the MicroDex processing technique.

PREMIUM QUALITY MATERIALS — Processed by advanced methods in the world's finest carbides plant, only the choicest raw materials are used in MicroDex inserts. Yet you pay no more for them than for other inserts!

PROVE IT FOR YOURSELF!

1. Before approving any inserts for use in your plant, check their suitability with the Valenite insert checking kit. (Consists of comparator fixture, dimensional templates for all standard squares, triangles and diamonds.)*
2. Run a side-by-side comparison of insert life, machine downtime, part accuracy and finish using MicroDex inserts and any other inserts. Then specify the insert that gives you more of the advantages inherent in throwaway tooling!

***For complete information write to Valenite's Technical Services Dept.** *Request Catalog A*

VALENITE® METALS
DIVISION OF THE VALLEROY CORPORATION

BOX 205
ROYAL OAK, MICHIGAN

BIG, 6-FOOT

LAPOINTE

ROTARY TABLE

of extreme accuracy...

can take loads up to 50 tons!

Indexing is semi-automatic or full-automatic, as desired, and guaranteed accurate within 10 seconds of arc. It will repeat consistently to within 5 seconds! Never before has a big production table been built offering such precision. Using master indexing gears, this Lapointe Rotary Table *cannot lose its accuracy*, regardless of the weight of the workpiece!

For programming, for tracing. Although originally developed by Lapointe as a broaching fixture, in smaller sizes, this Rotary Table can now be purchased separately and used for other machining purposes. Any external form can be milled or contoured to extreme accuracy. It will tilt to 90°. Can be made in any diameter from 30" up to 120".

Write for illustrated Bulletin RT-1

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS — U. S. A.
in England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE
known to be the best in
BROACHING

straight sides and square corners. Totalizing counters record number of sheets fabricated and number of actual pieces obtained.

The package device is furnished complete with all external sensors and photocells, requiring only connection to a power source and mounting. Dimensions are 20-in. height x 16-in. width x 6-in. depth.

Sensory Inc., 504-252 Pleasantville Rd., New Vernon, N.J. **T-8-37**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cylinders

Two lines of Allenair cylinders, Types AN & BN, have a fork type rear head for mounting, stainless steel rods, Nylined bearings, high tensile aluminum heads, honed brass or steel tubing treated for corrosion resistance, and a choice of fixed or adjustable cushions

for either end or both. Bore sizes available include 7/8, 1 1/8, 1 1/2, 2, 2 1/2, 3 and 4 in.

Type BN cylinders use cups for the piston head seals instead of the O-ring packing which is used on Type AN. Double packing for the rod gland also is provided on the Type BN. All cylinders are available as double-acting or single-acting spring return.

The A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y. **T-8-38**

Drum Lift

Model BM 3 High Boy Sterling hydraulic drum lift, will lift drums and containers to a maximum height of better than 72 in. for ease in pouring contents into mixing vats, tanks, etc.

The hydraulic jack is actuated by a foot-operated pedal and will lift at the rate of 1 1/2 in. per pedal depression. Lifting weight capacity is 750 lb. It is mounted on 4 in. oil, gas and spark-proof ball-bearing casters for easy maneuverability and safety in hazardous areas. A floor-lock holds unit rigidly in position, and a drum lock holds drums in pouring position. Release of drum lock permits rotating drums 360

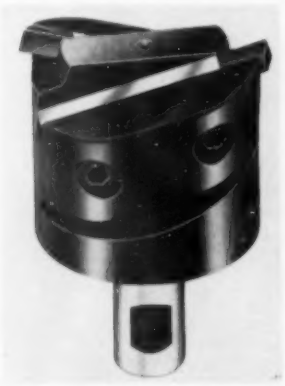
deg for mixing contents before pouring.

The unit can be equipped with a girdle to handle either standard 55 gal or 30 gal steel drums or fibre containers up to and including 23 in. dia. Special girdles for handling cylinders, carboys and other steel barrels are also available.

Dept. TE, Sterling, Fleischman Co., P. O. Box 94, Broomall 3, Pa. **T-8-39**

Heavy-Duty Milling Cutter

This Manchester heavy-duty inserted-face mill cutter, made of SAE 4140 heat-treated steel can take 2½ in. dia



cut. Shear cutting action of the double inserts offer a fast, well finished surface. Carbide inserts can be changed quickly and are easily reset with a tool setting gage, furnished with each cutter, which assures equal tooth load. Settings

NEED SPECIAL TOOLING?

Total working time for this accurate, low-cost, durable drill jig — just 35 minutes.

Make complicated jigs, fixtures and holding devices in MINUTES with

PLASTIC STEEL® A DEVCON PRODUCT
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PLASTIC STEEL makes a precision form of the original part . . . without shrinkage or distortion. Handles like modeling clay . . . hardens to strong, tough metallic piece. PLASTIC STEEL can be sawed, tapped or ground with metal-working tools. It has extreme strength, adhere to most materials, will not rust or corrode.

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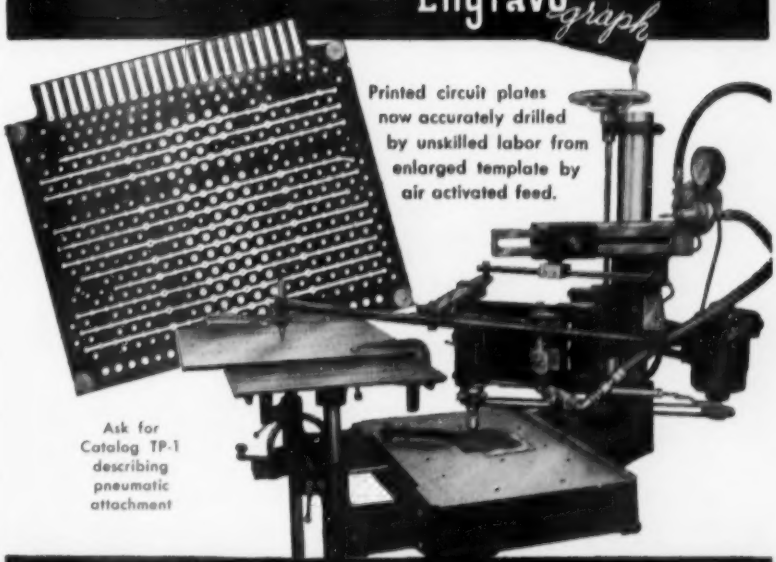
100 HOLES P. M.
WITH NEW HERMES Engravograph


Printed circuit plates now accurately drilled by unskilled labor from enlarged template by air activated feed.
Ask for Catalog TP-1 describing pneumatic attachment

new hermes ENGRAVING MACHINE CORP.
13-19 University Place, New York 3, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-165-2

can be made at the mgachine. Inserts can be sharpened on off-hand grinders. A special double V-clamp design makes registering automatic.

The tool is available with ¾ or 1 in. dia shanks.

Portage Double Quick, Inc., 1054 Sweitzer Ave., Akron 11, Ohio. **T-8-40**

Holding Device

This Tork-lok fixture (drawbar model) combines the arbor with a flanged adapter into which is incorporated the actuating mechanism for the arbor. Seven fixtures cover the range from ½ to 2⅝ in.

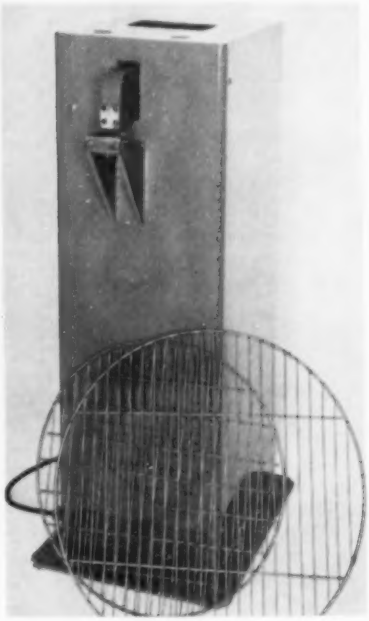
Operations on which the holding device is useful include drilling, reaming, tapping, milling, surface grinding, gear

shaping, gear hobbing, burring. It also offers possibilities in automation type units and in built-up gaging units.

N. A. Woodworth Co., Sales Div., 1300 E. Nine Mile Rd., Detroit 20, Mich. **T-8-41**

Wire Trimming Machine

Motor-driven wire trimming machine for high production runs is simple to operate. Wire products are simply guided by the operator along the cutting die. The machine gives a clean



cutoff and operates at 450 strokes per minute. Maximum capacity is 5/16-in. diam wire. The machine comes complete with a ¾-hp motor. Special round-bottom cut-off dies also are available for a variety of work.

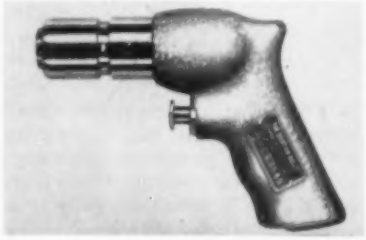
A scrap ejection feature causes scrap to automatically drop into scrap collection box.

Artys Sales Co., 11 Broadway, New York 4, N. Y. **T-8-42**

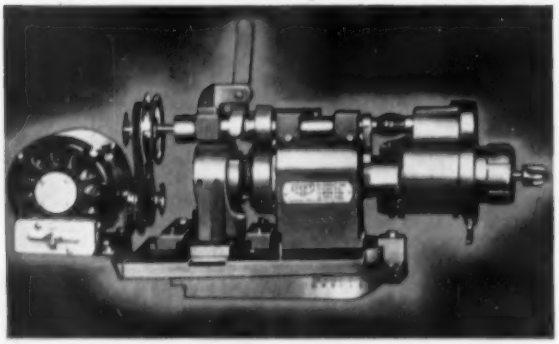
USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Air Hammer

This 20-oz air hammer incorporates a metering trigger which lets the operator control blows per minute from 0 to 13,000. The tool, designated the Bantam Bully air hammer, measures 6 in. long



Precision CIRCULARITY GRINDING ATTACHMENT

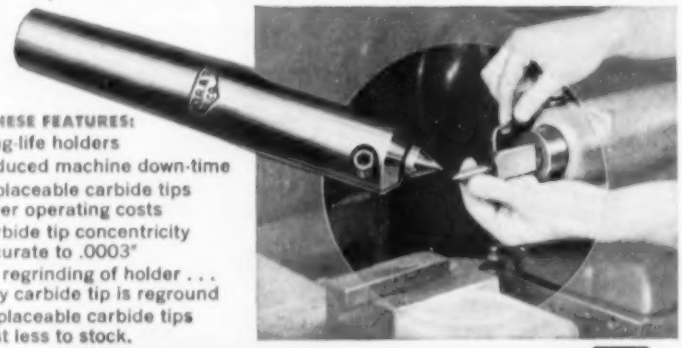


Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, a combination of form and radial relief, tapered cylindrical and straight cylindrical.

Model 500 Circularity Grinding Attachment is faster—easier to handle—has positive control—greater adaptability—rugged construction—is engineered and built to provide the finest precision work.

You Can Grind Tools Like These On A DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT

Grip-Tip CENTERS—Replaceable Carbide Tips



CHECK THESE FEATURES:

1. Long-life holders
2. Reduced machine down-time
3. Replaceable carbide tips lower operating costs
4. Carbide tip concentricity accurate to .0003"
5. No regrinding of holder . . . only carbide tip is reground
6. Replaceable carbide tips cost less to stock.

DETROIT REAMER & TOOL CO.

760 WEST MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICHIGAN

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-8-169-1	Ace Drill	**Carbide Drills**—Catalog contains data on Ace "Ground-from-the-solid" drills and H.S.S. drill blanks. (Page 169)
A-8-44	Adamas Carbide Corp.	**Carbide**—"Grade A . . . Metallurgical Facts and Application Tips" gives engineering details. (Page 44)
A-8-16	Allegheny Ludlum Steel Corp.	**Carbides**—Carmet catalog contains data on all carmet grades and on carmet blank tools and gives engineering applications. (Page 16)
A-8-59	American Broach & Machine Div. Sundstrand Machine Tool Co.	**Broaching Machines**—Practical broaching methods described in bulletin A717. (Pages 58-59)
A-8-9	The American Tool Works Co.	**Lathes**—Deluxe model Pacemaker illustrated and described in bulletin 116. (Page 9)
A-8-179	Armstrong-Blum Mfg. Co.	**Saws**—Marvel catalog gives story on Marvel metal-cutting saws. (Page 179)
A-8-181	Avey Division, Motch & Merryweather Machinery Co.	**Drilling Machines**—Bulletin 252 describes single and multiple-operation drilling machines. (Pages 180-181)
A-8-63	The Bellows Co.	**Air-Power Devices**—Package work units, work and tool feeders, holding devices, air motors and controls described in Bulletins ML-3 and BM-25. (Page 63)
A-8-46	The Blanchard Machine Co.	**Special Machines**—"The Art of Blanchard Surface Grinding" and 5th edition of "Work Done on the Blanchard," give engineering details. (Page 46)
A-8-178	Chicago Rivet & Machine Co.	**Rivets**—Catalog contains engineering data and rivet specifications. (Page 178)
A-8-232	The Cincinnati Milling Machine Co.	**Special Machine**—Cincinnati 28" vertical Hydro-Tel milling machine described in Catalog M-1773-2. (Page 232)
A-8-211	The Cincinnati Shaper Co.	**Shaper**—Bulletin "Cincinnati Rigid Shapers" gives applications and engineering specifications. (Page 211)
A-8-155	Circular Tool Co., Inc.	**Cutting Tools**—Catalog O contains data on Circle R slitters. (Page 155)
A-8-216-3	J. Arthur Deakin & Son	**Special Machines**—Catalog D describes Alexander die sinkers and other special British machines. (Page 216)
A-8-271	Denison Engineering Div. American Brake Shoe Co.	**Multipress**—Catalog ASY-5 describes Denison hydraulic multipress. (Page 271)
A-8-43	DeVlieg Microbore Div. of DeVlieg Machine Co.	**Special Tooling**—DeVlieg Microbore catalog lists 332 standard, general-purpose boring bars. (Page 43)
A-8-67	Eastman Kodak Co.	**Projectors**—"Projection Gaging with Kodak Contour Projectors" describes Kodak simplification of measurement problems. (Page 67)
A-8-243	Elgin National Watch Co.	**Cutting Tools**—Catalog contains listing of Elgin line of solid carbide end mills, drills, reamers and burs. (Page 243)
A-8-216-2	Firth Loach Metals, Inc.	**Carbides**—Booklet contains data on carbide engineering. (Page 216)
A-8-247	Firth Sterling, Inc.	**Carbides**—Three new carbides described in Bulletins SL 2101, SL 2096 and SL 2079. (Page 247)
A-8-26	The Foote-Burt Co.	**Broaching Machines**—Circular No. 503 describes Footburt continuous surface broaching machines. (Page 26)
A-8-188-2	The Gaertner Scientific Corp.	**Microscope**—Bulletin 147-56 describes models and gives specifications for toolmakers' use. (Page 188)

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A-8-13	Gisholt Machine Co.	**Special Machines**—Booklet "Superfinishers" explains Gisholt super-finishing process. (Pages 12-13)
A-8-42	Greenlee Bros. & Co.	**Automatics**—Catalog A-405 contains information on Greenlee automatic bar machines. (Page 42)
A-8-189	The B. Jahn Mfg. Co.	**Dies**—Catalog contains case histories and engineering specifications. (Page 189)
A-8-161	Lamina Dies and Tools, Inc.	**Press Supplies**—Catalog contains information on guide pins and bushings for regular or special applications. (Page 161)
A-8-256-2	Lovejoy Tool Co.	**Cutting Tools**—Catalog 33 describes Lovejoy milling cutting arbors and flywheels. (Page 256)
A-8-215	Mall Tool Co.	**Air Tools**—Catalog describes Mall line of air tools. (Page 215)
A-8-245	The McKay Machine Co.	**Special Machines**—Booklet contains data on McKay press feed and cut up equipment. (Page 245)
A-8-250-1	W. F. Meyers, Inc.	**Cutting Tools**—Bulletin No. 52 contains data on solid carbide or carbide tipped tools. (Page 250)
A-8-203	Oakite Products, Inc.	**Special Products**—"How To Strip Paint" and "Here's the Best Short Cut in the Field of Organic Finishing" describe better ways to strip paint. (Page 203)
A-8-200	Ortman-Miller Machine Co.	**Cylinders**—Bulletins 101A and 105 describe removable rod gland cartridge, exclusive with the O-M series T-H hydraulic cylinder. (Page 200)
A-8-224-1	Pangborn Corp.	**Special Machines**—Pangborn Hydro-finish described in Bulletin 1403. (Page 224)
A-8-259	Perry Equipment & Engineering Co.	**Machine Attachments**—Vibratory parts feeders described in Bulletin 365. (Page 259)
A-8-269	R and L Tools	**Cutting Tools**—R and L tap and die holder and other R and L turning tools described in catalog. (Page 269)
A-8-218	Rivett, Inc.	**Cylinders**—Catalog No. 106 gives drawings, specifications, cutaway views, tables and diagrams of Rivett 1500-psi cylinders. (Page 218)
A-8-156	Rockford Clutch Div. Borg-Warner	**Clutches**—Bulletin shows typical installations of Rockford clutches and power take-offs. (Page 156)
A-8-50	Rotor Tool Co.	**Air Tools**—Bulletin 51 describes Rotor 180 cycle tools and Bulletin 48 describes Rotor 360 cycle electric grinders. (Page 50)
A-8-57	Sundstrand Machine Tool Co.	**Special Machines**—"Engineered Milling Production" available in Bulletin No. 782. (Pages 56-57)
A-8-229	The Thompson Grinder Co.	**Surface Grinders**—Booklet gives facts on new Thompson Hydra-Cool Hydraulic System. (Pages 228-229)
A-8-150	Tomkins-Johnson	**Cylinders**—Catalog SM56 gives engineering details on Spacemaker line. (Page 150)
A-8-204-1	Twentieth Century Mfg. Co.	**Cutting Tools**—Catalog lists reamer selection and gives tool specifications. (Page 204)
A-8-248	Verson Allsteel Press Co.	**Presses**—Catalog G-57 presents basic data on all types of Verson presses. (Page 248)
A-8-217	Waldes Kohinoor, Ir.	**Grooving Tool**—Waldes Truarc grooving tool described in technical manual. (Page 217)
A-8-234	Wesson Co.	**Metal**—Bulletin No. 57-1 WM tells "inside story" on grades of tungsten carbides. (Pages 233-234)
A-8-212	S. B. Whistler & Sons	**Dies**—Catalog describes Whistler adjustable perforating dies. (Page 212)

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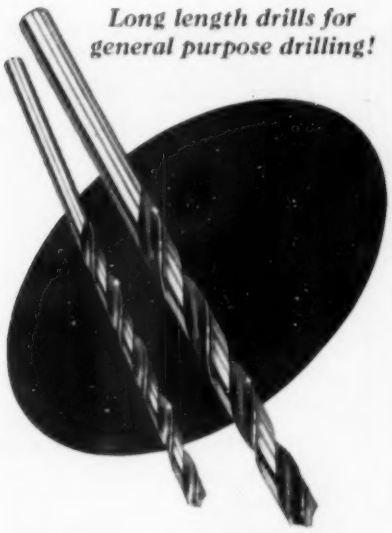

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Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks, and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

INDICATE A-8-169-1

and uses 6.5 cfm at 90 psi.

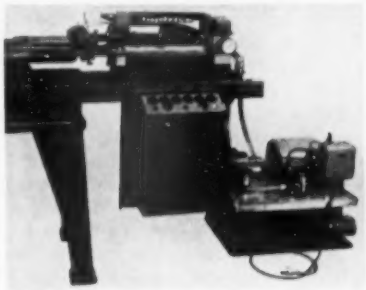
Twenty-four different tools for scaling, chiseling, peening, metal-cutting, star drilling, etc., are available for use with the hammer body. A slip chuck snaps the various tools in or out easily and can be locked in eight different positions.

Superior Pneumatic & Mfg., Inc., 4758 Warner Rd., Cleveland 25, Ohio. **T-8-43**

Turret Drive for Self Indexing Lathes

Hydraulically operated turret drive called the Hydrive, is available for powering self-indexing lathes from bench size up to No. 5 turret lathes.

The unit is used to automate the turret, feed the cross-slide, change spindle speed, advance bar stock, reverse



direction of spindle rotation for tapping, and open and close the collet.

With the drive it is possible for one man to handle two machines or check and inspect parts while a lathe is running. Hydraulic operation of the machine results in steady, direct motivation.

Acme Industrial Co., 200 N. Laflin St., Chicago, Ill. **T-8-44**

Testing Machine

Combination device, called the Air-O-Stress-Rupture and Creep testing machine, is air operated and provides versatility for all types of stress rupture and creep tests. Applied load is indicated on a large dial at the top of the machine. Amount of elongation under a prevailing load can be plotted automatically on a built-in electronic recorder, an optional feature.

Available in 12,000 or 20,000-lb capacities, this machine meets all ASTM and Federal requirements for accuracy. Infinitely selectible loads can be applied and maintained for any period of time from minutes to years. This accurately regulated load is maintained on the specimen regardless of physical changes. Separate temperature controls enable the operator to select any fur-

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nace testing temperature up to the limit of the unit—1800 or 2000 F.

Operating simplicity and few moving parts incorporated in this machine, minimize maintenance. Compact construction and comparatively light weight make it possible to move or operate the unit without leveling or erection of a special foundation.

Tinius Olsen Testing Machine Co., 5987 Easton Rd., Willow Grove, Pa.

T-8-44A

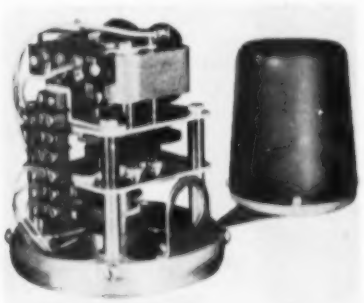
Gear Motor

Shaft mounted gearmotor, designated Shaftrol, has a built-in potentiometer that provides remote indication and control for valves, variable speed drives, gates, jacks, and variable displacement pumps. The potentiometer may also serve in bridge circuits of automatic control systems. Control may be by dial control, by push button (as indicated in the photograph) or it may be automatic from limit switches, controllers or proportioning devices.

The unit mounts on any shaft that normally takes a handwheel, knob or lever from $\frac{1}{4}$ to 1 in. in diameter through use of a mounting shaft collar. A torque arm compensates for any runout that may be present in the shaft. A wide range of operating speeds and torques can be had by specifying the desired ratio of the 3 or 4 stage reduction gearing. A variety of potentiometer gear ratios are available to provide full scale deflection of the calibrated meter for rotation of the driven shaft from 1/6 to 40 or more revolutions.

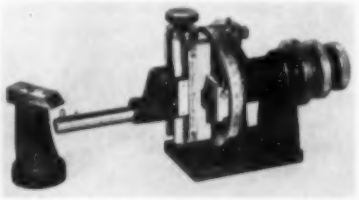
When the potentiometer is used as a part of a bridge circuit, the standard Shaftrol provides follow-up accuracies of ± 1/5 percent of full scale. With precision multiturn potentiometers, accuraries of 1/25 of 1 percent can be had with counter read out if preferred.

The Jordon Co., Inc., 3235 W. Hampton Ave., Milwaukee 9, Wis. **T-8-45**



Wheel Dresser

Designed to reduce the precision dressing of grinding wheels to a simple routine operation, the Tangi-Matic quickly dresses grinding wheels to any form. Accuracy is insured by form-dressing at the wheel bottom, thus avoiding errors on grinders where the spindle is not exactly true with the chuck. Grit particles dressed from the wheel are thrown away from the dresser for clean, safe operation. Wheel guard need not be removed during the operation. All corners of the dresser are undercut to facilitate cleaning with an air



jet. The Tangi-Matic can be operated either right or left handed.

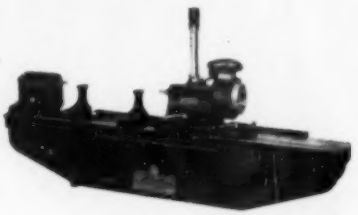
The self-contained tool has its own direct reading scales to facilitate setups. After the diamond is zeroed to the master setting block, all settings are made by means of the direct reading micrometer-type adjustment for the desired radius, and the direct reading dial and vernier for the desired angle. Tangent settings are milled in degrees and minutes for accuracy.

Threadwell Tap & Die Co., Greenfield, Mass. **T-8-46**

Jigborer

Worktable of Model 35-NC jigborer can be positioned longitudinally and crosswise in accordance with readings in 0.0001 in. by optical setting devices scanning precision scales located in the

Basic Equipment for Higher Precision



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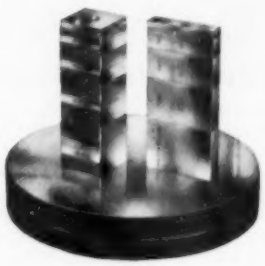

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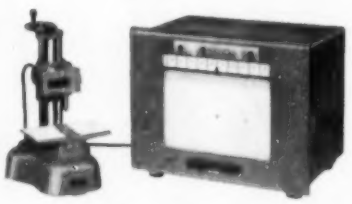

P & W ELECTROLIMIT MILLIONTH COMPARATOR
. . . was developed by Pratt & Whitney for checking Precision Gage Blocks to a millionth of an inch. An essential item of basic measuring equipment for every plant that must establish and maintain truly high master standards of accuracy.

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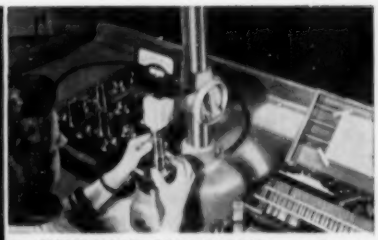

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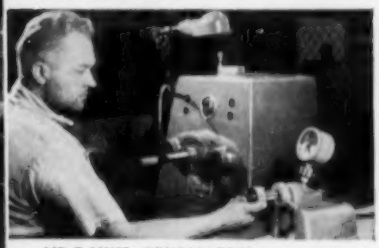

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ELECTROLIMIT SUPERMICROMETER . . . reads direct to .0002". Used as a comparator, it tells operator at a glance exactly how much a part is over or under the required dimension.

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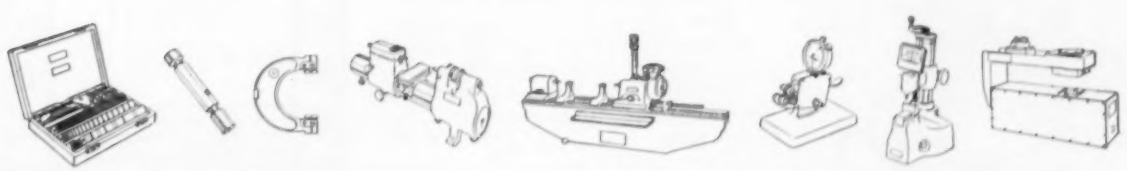

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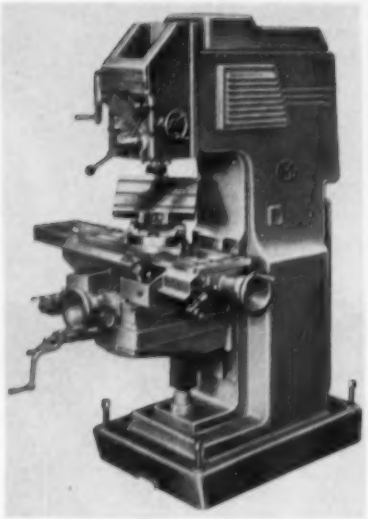
MACHINE TOOLS • GAGES • CUTTING TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-171



saddle and knee. Table size is 33½ x 12 in. Table movements are 21½ x 12¼ in. Lead screw nuts are adjustable.

Spindle drive is by 2½ hp a-c motor. Spindle speeds are infinitely adjustable from 96 to 1720 rpm. Spindle has No. 3 A.S.A. taper and quick-acting tool retainer nut.

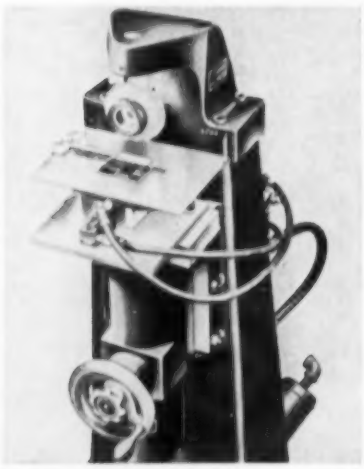
Power feed at 3 rates is provided for 5½ in. boring depth.

The machine can be equipped with coolant system, machine light fixture, optical centering device and a variety of work-holding devices.

Manufactured by G. Matheys of Brussels, Belgium; distributed by Triplex Machine Tool Corp., 75 West St., New York 6, N. Y. **T-8-47**

Detail Press

This floor model power detail stamping machine is used for marking details into metal components. A shop air line provides power for the tool which can be used for marking metal from 1/32 up to 4 in. thick.



Shop air pressure requirements vary from 20 to 40 lb., depending upon the depth of impression required. The machine can be equipped with dials ranging from 1/16 to ¼ in.

Only 3 minutes time is required for changing dials. All are engraved with 27 letters, 10 figures, period, fraction line and dash.

Geo. T. Schmidt, Inc., 4100 N. Ravenswood Ave., Chicago 13, Ill. **T-8-48**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Angle-Computer Fixture

Combination instrument and machine fixture, called the Derry Triangulator, consists of two 360-deg protractors set at 90-deg angle to each other with mounting plates top and bottom. By the use of quick release clutches any compound angle on a spherical arc can be quickly set, locked and adjusted to within one minute of arc. Because of its sturdy construction, the device is

practical for production machine work.

Common axis center-of-gravity rotation prevents sag or sway by minimizing load leverage. The instrument-fixture comes in two sizes with 90-deg load capacities of 150 or 300 lb.

Steel worm gears on each protractor, coupled with clutch type locks, enable the instrument-fixture to positively hold any angles set on the expanded vernier.

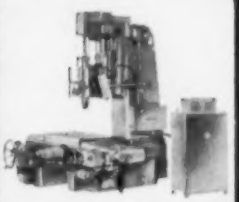
Machine Tool Division, Service & Suppliers, Inc., 706 Kellog Ave., Glendale, Calif. **T-8-49**

Spline Arbor

Tork-Lok arbor with interchangeable collet for splined parts has been developed for grinding OD and flanged face true to the pitch diameter of a coupling housing. The collet locates on the pitch diameter of the spline assur-

Because
"SEEING IS BELIEVING"
let this film show you how

THE
PRATT & WHITNEY
Electrolimit
JIG BORER



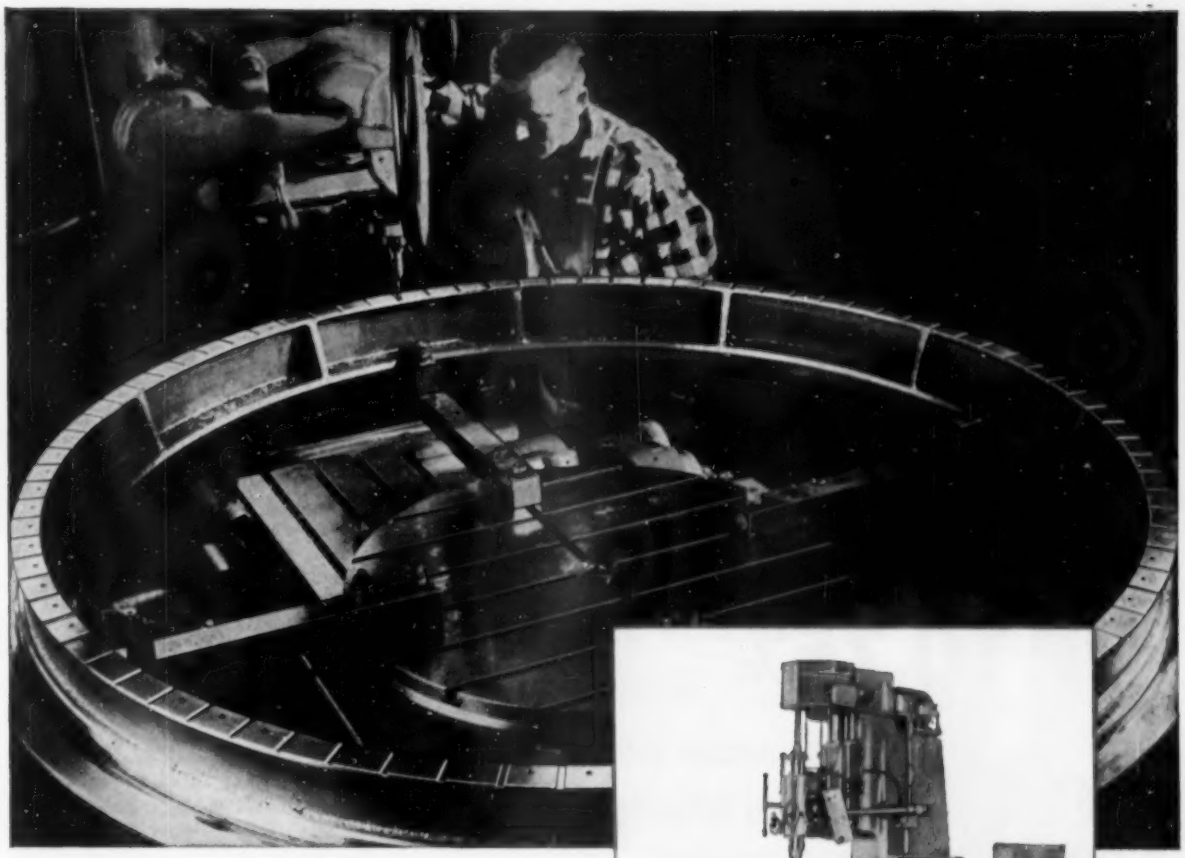
- INCREASES ACCURACY
- HELPS ELIMINATE COSTLY ERRORS
- IMPROVES WORK QUALITY

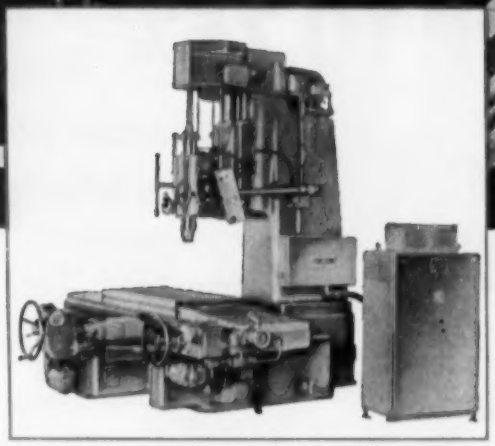
And
- REDUCES PRODUCTION COSTS IN THE TOOLROOM *AND ON THE PRODUCTION LINE!*

Arrange Now . . .
for a showing of the new 16 mm sound motion picture film in full color.
"ACCENT ON ACCURACY"

Write on your company letterhead to Pratt & Whitney Company, Inc., 16 Charter Oak Blvd., West Hartford 1, Conn.

PRATT & WHITNEY
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES
CUTTING TOOLS





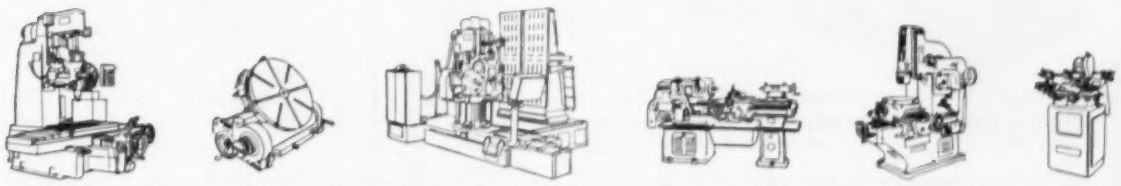
PRECISION plus BIG CAPACITY

P&W JIG BORERS WITH OPEN-SIDE CONSTRUCTION

Nearly 6 feet in diameter, the aircraft tooling fixture shown above was really big! It required machining 84 slots and boring 84 holes on the face and machining 84 slots on the flange. *All* 252 slots and holes had to be equally spaced and located within ± .001" of true radial. Handling jobs like this with ease and efficiency takes the combination of high precision and big work capacity you'll find only in a Pratt & Whitney Jig Borer with Open-Side Construction.

Pratt & Whitney Jig Borers – both Electrolimit and End-Measure types – are produced in complete lines for every work size requirement. All types and models will locate accurate to .0001" . . . and will retain this initial high precision and rigidity *indefinitely!* Get complete information now.

Write for your copy of Circular No. 587. Pratt & Whitney Company, Incorporated, 16 Charter Oak Boulevard, West Hartford 1, Connecticut.

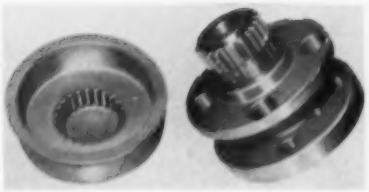


JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



ing concentricity of 0.0005 T.I.R. in the machining of this part.

This is only one of the special applications for which this tool is suitable.

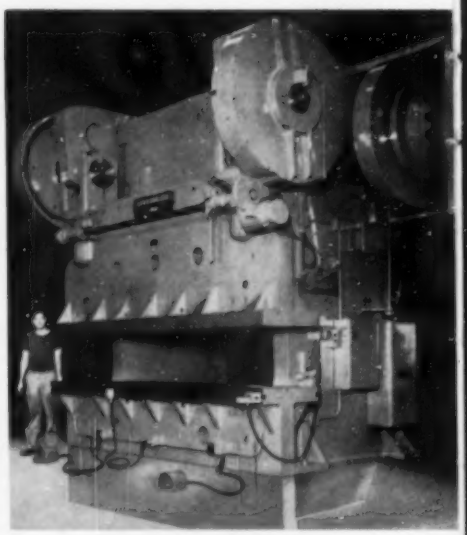
N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit 20, Mich. **T-8-50**

Press Brake

The 40 series Cincinnati press brake measures 8 ft 6 in. between housings, and has an overall die surface of 12 ft. Both bed and ram are permanently widened to 28 in. to permit mounting of heavy corrugating and punching dies.

Stroke of the press is 8 in. and shut-height is 22 in. The machine is equipped with a power take-off from the main shaft for driving automatic feeding and withdrawal units. It has air-electric clutch control and all-steel, interlocked construction.

Two-speed, totally enclosed transmission permits operation at 5 or 20 strokes per minute.



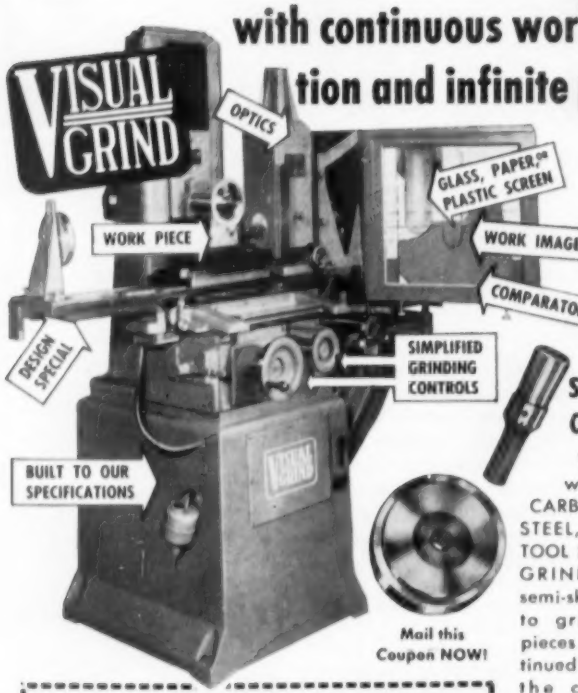
The Cincinnati Shaper Co., Happle, Garrard and Elam Sts., Cincinnati 25, Ohio. **T-8-51**

TOP FIRMS SHOW

PROVED SAVINGS

UP TO 75% in Set-up and Grinding Time

with continuous work inspection and infinite precision



SIMPLIFIED OPERATION

When working with TUNGSTEN CARBIDE, STAINLESS STEEL, STELLITE or TOOL STEELS, VISUAL GRIND permits a semi-skilled operator to grind precision pieces without continued checking with the comparator. Automatic inspection is accomplished with the built in optical comparator.

Visit our plant . . . let us show you how VISUAL GRIND will speed production — cut costs.

Mail this Coupon NOW!

CLEVELAND GRINDING MACH.
1680 Eddy Road Cleveland 12, Ohio

Gentlemen:

☐ Please have your representative call at our plant. The most convenient time would be (week) .....

☐ Phone for appointment

☐ Please send us complete information on the new VISUAL GRIND.

NAME ..... TITLE .....

COMPANY .....

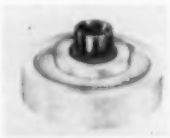
ADDRESS .....

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-174

Bearings

These Rolset bearings, a combination of stud and nylon roller, are pre-assembled before shipment and are offered as an economical substitute where molded nylon parts and studs are presently being handled as separate units.

Self-lubricating quality of the nylon roller assures quiet operation, smooth



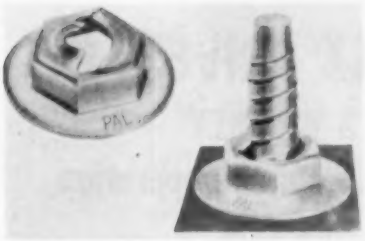
rolling action, and resistance to wear under loads.

The stud can be produced of either zinc or cadmium plated steel, stainless steel or aluminum. It is left soft for riveting and can also be supplied threaded, knurled or grooved for special assemblies.

General Bearing Co., Inc., 47 Roselle St., Mineola, N. Y. **T-8-52**

Self-Threading Lock Nut

Self-threading lock nut cuts its own threads on die-cast or cold-forged studs. The fastening operation does the thread cutting during the tightening. Strong,



resilient spring locking action will not loosen during service.

The nuts, in hex form which fits standard tools and shanks, consist of a thread cutting lock nut and flat washer in one piece, in sizes for 1/8, 3/16 and 1/4 in. unthreaded studs. It cuts deep, clean threads having high torque and tensile values and may be removed and reused on the same studs. The resilient washer base assures 360 deg contact on flat or irregular work surfaces, and on perpendicular or off-angle studs.

The nuts are available plain or with bonded-in Plastisol sealer for assemblies requiring protection against water and dust.

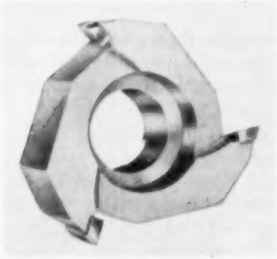
The Palnut Co., Glen Rd., Mountainside, N. J. **T-8-53**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Tipped Shell End Mills

Series 400, 3 flute carbide-tipped shell end mills, for use with standard type C arbors, are designed for face milling aluminum magnesium, brass or bronze alloys and plastic materials.

Carbide tips are sandwich brazed to the alloy body, making a strong, one-



piece cutting tool that will safely withstand ultra high-speed operation.

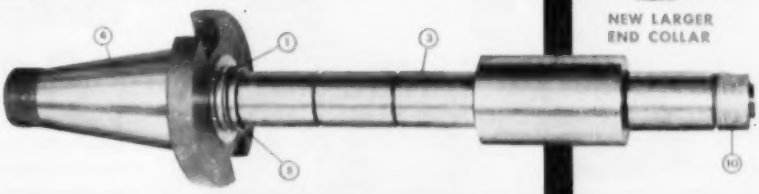
Three tooth design allows room for chip flow, and the odd tooth construction results in fine finish on soft materials.

Carbide tips protrude above cutter body to avoid snagging the steel body with diamond wheel when regrinding.

Nelco Tool Co., Inc., Manchester, Conn. **T-8-54**

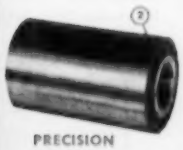
EXCLUSIVE NEW FEATURES OF SCULLY-JONES ARBORS

give you extra-precision milling at the same low cost!



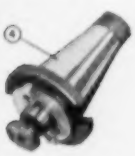
NEW LARGER END COLLAR

These benefits	...for these reasons	...result from these PREMIUM features
PREMIUM ACCURACY	No "cocking" of spacers when "snubbed up" on arbor.	1. New, larger end bearing and collar insure perfect alignment; 45 deg chamfer in collar for clearance over fillet.
		2. Bore and outside diameter of bearing sleeves concentric within .0005 in.; faces of sleeves and collars parallel within .0002 in.
PREMIUM TOOL LIFE	No runout, each tooth of cutter takes its share of the load.	3. Arbor and pilot diameter held to plus .0000, minus .0005 in. with .0005 in. minus tolerance.
		4. Taper held within .0002 in., with 10-20 micro-inch finish.
		5. New, larger size and grooved OD make it easy for operator to identify end collars, help to prevent mistakes.
PREMIUM PRODUCTION	Reduce down-time.	6. Keyways standard in all sleeves and collars. Can be keyed to arbor to prevent rotation.
		7. True-running arbor helps eliminate premature cutter failure.
	Reduce setup time.	8. Adjustable spacing collar speeds adjustment between gang mills and saws.
PREMIUM ARBOR LIFE	Accuracy lasts longer.	9. Forged steel arbors hardened throughout to 42-45 Rockwell, "C". Sleeves hardened on OD and faces to 60 Rockwell, "C". Collars hardened throughout to 40-45 Rockwell, "C".
		10. Hardened and ground threads for arbor nut.
	Fortified against breakage under heavy loads.	11. New, larger fillet increases strength at stress point between arbor and shank.



PRECISION BEARING SLEEVE

SOLID AND ADJUSTABLE SPACING COLLARS



SHELL END MILL ARBORS

SCULLY JONES

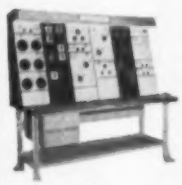
Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1915 South Rockwell St., Chicago 8, Ill.

For profit-minded tool buyers!

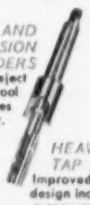


"TOOLITROL" BOARDS

Take the human element out of multiple-spindle operations, help control quality and production.

NEW TENSION AND COMPRESSION TAP HOLDERS

Lock-and-eject chuck speeds tool changes, increases holding power.



HEAVY-DUTY TAP DRIVERS

Improved snap-ring design increases accuracy and holding power, speeds tool changes.

PRESETTING TOOLS

Reduce setup time, downtime, and inspection time by as much as 50 per cent.

TURRET TOOL HOLDERS

Hardened and precision ground to resist nicking and wear, assure accurate tool alignment.

CLOSE CENTER TAP DRIVERS

New design with four-slot chuck increases resistance to pull-out, keeps taps running true.

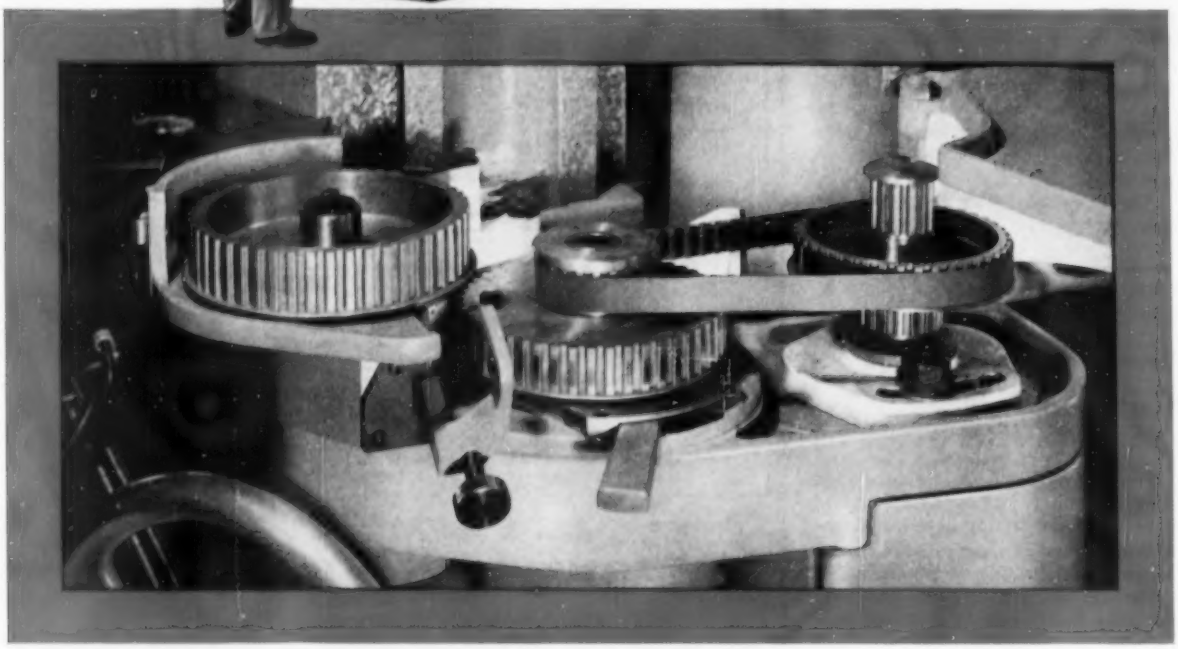
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-175

Gilmer "TIMING" BELT DRIVES

give PRATT & WHITNEY vibrationless spindle operation at 48 to 11,500 rpm.

Pratt & Whitney
Model 104
Electronic Template
and Cam Machine

HERE is a modern miracle of machine design: an electronically controlled machine tool that works directly from a *drawing* to produce finished metal parts . . . without the need for costly master formers. Its non-contacting, spark-gap tracer disc automatically follows the conductive lines of an enlarged drawing to guide the tool in cutting highly accurate templates and cams—both internal and external.



In keeping with its embodiment of the latest engineering advances, this Pratt & Whitney machine uses Gilmer "Timing" ® Belts to drive the spindle at constant angular velocities, assuring the finest finishes and maximum tool life. Belts can be changed readily to any of three positions, in the manner of change gears, to provide various spindle speed ranges, permitting use of either High Speed Steel or carbide mills and small diameter grinding wheels.

The design engineer for Pratt & Whitney states, "From the very concept of this machine the Gilmer 'Timing' Belt principle was selected, and has proved to be a wise selection giving trouble-free power transfer throughout the exceptionally wide spindle speed range of 48 rpm to 11,500 rpm. The belts are used to insure positive drive with absolutely no slip and vibrationless operation of the spindle."

Are you planning one of the "machines of tomorrow"? Then follow the example of leading machine tool builders, both here and abroad, and design it around the Gilmer "Timing" Belt drive—the only type of drive that assures positive power transmission without need of lubrication! Your NYB&P Distributor can supply you with engineering data, as well as with Gilmer "Timing" Belts and pulleys.

NYB&P

NEW YORK BELTING & PACKING CO. 1 Market St., Passaic, N. J.

Proving for 111 years that QUALITY COSTS LESS!

Men at Work

Nine executive appointments and promotions at The Sheffield Corp. involved **E. M. Hakanson** who was appointed manager and **C. H. Laemmel** who was named assistant manager of the Machine Tool Div. **D. H. McConnell** was made manager of the Autometrology Div. and **Henry Boppel** and **Arthur Wiseman** were named assistant managers. Mr. Boppel is a member of ASTE'S Dayton chapter. **Robert Esken** became supervisor of autometrology mechanical engineering and sales, and **Charles Brooks** was named assistant supervisor. **Robert Youngberg** was appointed supervisor of autometrology electrical engineering, and **Eugene Brinck** was named estimator and service supervisor, autometrology.

Former assistant superintendent of the Carbide Div. of Firth Sterling, Inc., **Thomas F. Nakles** has been appointed general manager of the recently formed Firth Sterling (Canada) Ltd. at Brantford, Ont.

William H. Welch and **Richard S. Russell** were elected president and vice-president in charge of production respectively of Sleeper & Hartley, Inc. Mr. Welch will also continue as treasurer of the company and also will head the company's sales and promotion program.

At its recent 12th annual convention the Industrial Diamond Association of America, Inc. elected **Willard L. Huber** of Diamond Tool Research Co., Inc., to serve as president for the coming year. **Morris Winston** of Diamond Drill Carbon Co. is now first vice-president, and **Donald J. Wallace** of Wheel Trueing Tool Co. was made second vice-president. Mr. Huber and Mr. Wallace are members of ASTE's Greater New York and Detroit chapters respectively.

Appointment of **Howard E. Morison** as vice-president of the Ingersol Steel Div. has been announced by Borg-Warner Corp. Mr. Morison formerly was associated with Crucible Steel Co.

Among recent appointments at Vickers Inc. was the promotion of **Russell Dupuis**, former Omaha plant manager, to the post of manufacturing manager, Machinery Hydraulics Div.

Earlier the company revealed appointment of **Robert A. Erskine**, as chief engineer, Industrial Dept., and **Carl E. Gunther** as chief engineer, Marine and Ordance Dept. Mr. Erskine was staff assistant to the vice-president and director of engineering. Mr. Gunther has been chief engineer of the Waterbury Tool Div.

Union Carbide Corp. has announced appointment of **Robert M. Briney** as president of its Haynes Stellite Co. division. He has been with the corporation since 1924.

C. Russell Mahaney has been elected president and director of The Society of the Plastics Industry, Inc. to serve for the next two years. He is vice-president and director of the St. Regis Paper Co., and general manager of its Panelyte Div. He succeeds **Norman Anderson**, president of General Molded Products, Inc., who was elected chairman of the board of directors of SPI.

Andrew L. Pontius was elected a vice-president of Illinois Tool Works. He will continue in his capacity as general manager of the company's Shakeproof Div.

Two executive appointments in research and operations are announced by Jessop Steel Co. **Louis A. Carapella** is now technical director of Jessop and its subsidiaries, and **Elmer I. Ghrist** was made general superintendent of the company. Dr. Carapella previously was a research director at the Metal Div. Research Center of Continental Can Co. Mr. Ghrist has been the company's director of research and metallurgy.

Thomas T. Arden is new president of Robertshaw-Fulton Controls Co. succeeding John A. Robertshaw who now is chairman of the board. Mr. Arden has been executive vice-president since 1947.

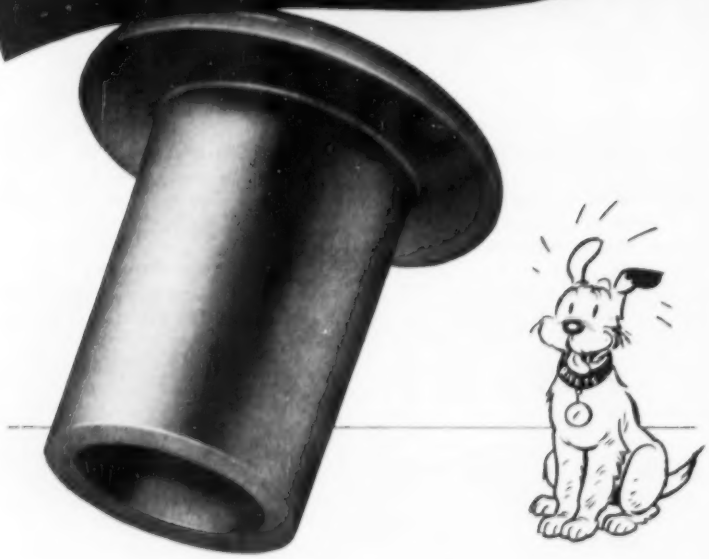
Eugene Caldwell is president of the Baker-Raulang Co. Formerly vice-president and general manager of the Hyster Co., he succeeds Percy L. Douglas who continues as a director of that organization.

Philip S. Hill has been appointed executive vice-president of Hyster Co. and is in charge of all company operations. Associated with the company for the past 20 years, he formerly was vice-president in charge of sales.

James C. Mabe, manager of plant operations, was elected vice-president of Chicago Pneumatic Tool Co. and will be in charge of all manufacturing and engineering operations in the company's six domestic plants.

Back of a *Chicago Rivet*

Is an Organization That Really Serves



The *RIGHT* rivet, plus the *RIGHT* riveting machine will produce a fastened assembly at the *RIGHT* low cost

The correct combination of rivet and machine requires expert knowledge available to you through Chicago Rivet engineers.

Anticipated production, type of materials to be fastened, assembly shape and its expected service life are factors to be considered. Decisions must be made on a rivet metal or alloy. Type and size of rivet, shape of head and shank, depth of tubular section must be all determined. Are indexing fixtures and multiple setters indicated? Can a standard rather than a special rivet be used? These are the type of questions Chicago Rivet Engineers are daily answering for industry. Their recommendations are available to you without cost. We suggest you send a blueprint or sample assembly with your inquiry.

There are *Chicago Rivet* Machines that will set

1
2
3
4
5
6

Tubular or Split Rivets At a Time

Chicago Rivet & MACHINE CO.

960 South 25th Avenue
Bellwood Ill. (Chicago Suburb)
Branch Factory: Tyrone, Pa.

FOR YOUR FILES
Rivet catalog describing 1388 standard tubular and split rivets and 26 single and multiple automatic rivet setters.

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-8-178

Robert N. Kendall was appointed vice-president of Colonial Broach and Machine Co. He has been serving Colonial recently as sales research consultant.

Gordon B. Carson, dean of The Ohio State University College of Engineering, is new president of the American Institute of Industrial Engineers.

Robert F. Rea is new director of engineering at Diamonite Products Mfg. Co., division of United States Ceramic Tile Co. Dr. Rea will be at the new research center at Shreve, Ohio, where experimental and pilot operations of high alumina ceramics are conducted.

Fluid Controls Institute Inc. at its spring meeting elected **John S. Leslie** of the Leslie Co. as president of the organization for the coming term. Former president **John C. Koch** was elected chairman of the board of directors.

New chief engineer for the Formsprag Co. is **Roger L. Daniels.** He previously was project engineer for the company.

Dale V. Cropsey has been named assistant to the president of Elgin National Watch Co. where he will specialize in development of its industrial divisions. He was previously associated with Potter & Brumfield, Inc. where he was vice-president and director of sales.

William J. Darmody, has been named technical metrology assistant to Louis L. Polk, president of The Sheffield Corp. Col. Darmody, who is retired chief of the Army Ordnance gage center at Frankford Arsenal and former mechanical engineer with the National Bureau of Standards will be in charge of coordination of Sheffield's basic and advanced metrology and measurement standards.

John H. Froelich has been appointed manager of production control for Universal-Cyclops Steel Corp. He will be responsible for production planning and control function for the company.

Charles W. Stewart of Washington, D. C. has been re-elected president of the Machinery and Allied Products Institute.

Potter & Brumfield, Inc. has announced appointment of **E. W. Gentz** as director of manufacturing. He succeeds **Howard Meuche** who resigned to become president and general manager of Universal Scientific Co., Inc. For the past nine years, Mr. Gentz has been vice-president and general manager of the automotive division of Sparks Withington Co.

Trade Literature

for free booklets and catalogs—use convenient request card, page 167

Broaching Tools

Pocket-size, 24-page booklet, "How To Care for Broaching Tools," offers helpful tips on handling of broaching tools while in use on a machine, when being resharpened and during transfer in the shop from one department to another. Photos and cartoons emphasize various points. The Lapointe Machine Tool Co., Hudson, Mass. **L-8-1**

Control Valves

Twelve-page illustrated Bulletin No. 571 on Quick-As-Wink air and hydraulic control valves covers sliding sleeve, single plunger, O-type, B-type and high-pressure units; describes construction and operation of each valve and service for which each is best suited. C. B. Hunt & Son, Inc., Salem, Ohio. **L-8-2**

Moldmakers' Supplies

Spiral bound, tab indexed, 170-page catalog describes and illustrates complete line of standard mold bases and moldmakers' supplies; includes specification tables and drawings and price lists; also incorporates section on platen data and tables. Request only on company letterhead direct to Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich.

Thread Tools

Illustrated thread tool catalog, Form #5701 provides information on J & L thread tools discussing their design, construction, advantages and applications; includes tables of dimensions and specifications. Jones & Lamson Machine Co., Springfield, Vt. **T-8-3**

Pipe and Tubing

Extensively illustrated 48-page manual presents story of stainless steel and high alloy Contour Trentweld created by patented welding process; covers production, quality control procedures, advantages of product and applications; separate section devoted to titanium tubing outlines its special advantages; 17 tables present data on hardness, conversion, size range, corrosion, gage and other information. Request only on company letterhead direct to L. E. Baker, Sales Supervisor, Trent Tube Co., East Troy, Wis.

Gaging

Illustrated, 96-page Catalog No. 36M covers company's entire line of precision tool and gage equipment including several hundred recently introduced items; includes specifications and prices plus discussion of construction, operation and important features of equipment. Indexed for easy use. Brown & Sharpe Mfg. Co., Providence, R. I. **T-8-4**

Honing Tools

Bulletin No. 570 describes how design of line of honing tools provide abrasive support for improved wear characteristics and how the designs are adapted to fit individual job requirements. Shows four major honing tool classifications with range of sizes and type of bores for which tools are developed. Barnes Drill Co., Rockford, Ill. **L-8-5**

5 Basic Reasons why MARVEL HACK SAWS CUT-OFF MORE ACCURATELY...

The consistently accurate performance of MARVEL Heavy Duty Hack Saws is no accident. MARVEL engineers knew, many years ago, that to produce and maintain accurate cutting-off, a hack saw must be designed and built like a fine machine tool.

Some of the basic design principles built into the modern MARVEL Hack Sawing System that makes it the most accurate cutting-off method you can use are:

1. V-Way Design...Greater Rigidity

Upright and Saddle are precision machined and fitted to form a rigid, integral unit capable of withstanding any cutting load with no deflection or side movement.

2. Anti-Friction Bearing Construction

Anti-friction ball or roller bearings are used at all load carrying points. Even the strongly braced saw frame reciprocates on heavy duty, fully enclosed preloaded ball bearings which provide permanent, frictionless rigidity and true-running, straight line cutting strokes.

3. Minimum Blade Frame Reach

Close-coupled design and crank lever action of MARVEL Saws keeps the saw frame and blade reach very short in relation to the vertical V-ways on which the unit is mounted. This insures optimum rigidity, even under the most severe operating conditions.

4. Positive Relief Blade Lift

On the return stroke, positive relief lift raises the blade to provide proper and "cushioned" lead-in on the next cutting stroke. This prolongs blade sharpness, life and accuracy.

5. Rigid Cutting Tool

Cutting-off accuracy requires a rigidly held, relatively short cutting tool. MARVEL Unbreakable High-Speed-Edge Hack Saw Blades, which combine a narrow high speed steel cutting edge permanently welded to a tough alloy steel body, can be tensioned from 200% to 300% more taut than ordinary blades. This provides a most rigid cutting edge.

Write for the MARVEL Catalog and the complete story on MARVEL METAL CUTTING SAWS

MARVEL Metal Cutting SAWS

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-179

Atmosphere Control

Bulletin 5702 describes Certain Curtain built-in atmosphere control method for various type heat treating furnaces, telling how it operates and its advantages. C. I. Hayes, Inc., 800 Wellington Ave., Cranston 10, R. I. **L-8-11**

Die Supplies

Illustrated by photos and drawings, 28-page, spiral bound Catalog No. 56 discusses company's supplies for die making and stamping industry, emphasizing features which provide speed, accuracy and safety; includes tables of specifications and dimensions. Superior Steel Products Corp., Milwaukee, Wis. **L-8-12**

Stainless Steel

More than 20 tables covering detailed data on stainless steel finder, corrosion resistance of various stainless steels, fabrication properties and weight tables per lineal foot in various widths and gages included in 32-page illustrated booklet on stainless steel and strip; also deals with proper selection of stainless grades and provides index of applications in various industries. Advertising Dept., Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa. **L-8-13**

Gaging

Well illustrated Magni-Gage folder designed to acquaint those who require precision gaging with company's service in preparing custom comparator charts, coordinated staging fixtures, precision photography, aircraft type layouts and templates and master art work for printed circuits. Industrial Lofting and Mfg. Co., Inc., Bridgeport, Conn. **L-8-14**

Carbide Tools

Complete line of tungsten carbide tools, tool tips, dies, wear parts, Dex-A-Tool (mechanical toolholder) and Ceralox (sintered aluminum oxide) described and illustrated in 32-page Catalog No. 357; also includes "Carbide Manufacturer's Grade Recommendations" chart. Adamas Carbide Corp., Kenilworth, N. J. **L-8-15**

Resistance Welding

Bulletin 8-313 describes resistance welders designed to mass produce electrical contact, conductor and terminal assemblies; illustrated to show samples of welded assemblies, special welding equipment and tooling required for mechanized handling. The Taylor-Winfield Corp., Warren, Ohio. **L-8-16**

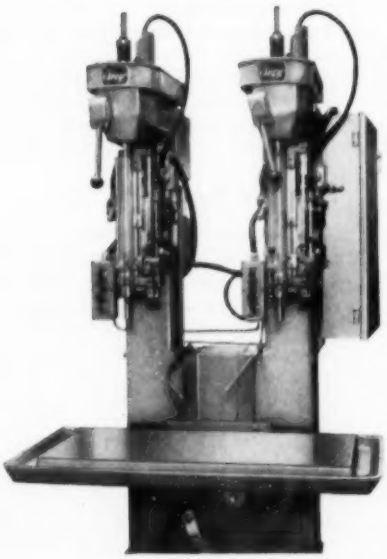
Tooling Resin

Comparative data Bulletin T-1 on Hysol tooling epoxy resin and hardeners includes information on application with regard to both room temperature and heat curing systems; covers physical properties, cure systems, product description, applications and characteristics; also suggests methods for industrial tooling, patterns, vacuum forms and fixtures. Tooling Div., Houghton Laboratories, Inc., 106 Houghton Ave., Olean, N. Y. **L-8-17**

Lubrication

Extensively illustrated, 16-page brochure, "Breaking Lubrication Barriers," covers history and development of Molykote line of molybdenum disulfide lubricants; offers technical information on physical and chemical properties of the compound with charts to illustrate lubrication achievement; includes catalog type selection table; photos showing variety of uses. The Alpha Molykote Corp., 65 Harvard Ave., Stamford, Conn. **L-8-18**

Here's automatic push-button



V-Drives

Well illustrated 46-page V-drive catalog, Form F-10, provides convenient source of information on fractional horsepower V-drives; includes descriptions, complete size data on the Maurey line of V-pulleys, V-belts, refrigeration fans and fan pulleys and V-drive accessories; special pages show application and action pictures. Final section of book incorporates engineering data section to help users select proper drive for particular requirements. Request only on company letterhead direct to Catalog Div., Maurey Mfg. Corp., 2915 S. Wabash Ave., Chicago 16, Ill.

Throw-Away Inserts

Profiling tools incorporating Kendex throw-away inserts are cataloged in Bulletin B-105; illustrated by dimensional drawings. Kennametal Inc., Latrobe, Pa. **L-8-19**

Positioners

Bulletin No. HD57 offers descriptions, specifications and optional extras for eight different models of company's gear driven welding positioners ranging from 500 to 24,000 lb capacities; well illustrated with drawings and photos. Aronson Machine Co., Arcade, N. Y. **L-8-20**

Your drilling operations become fast, automatic, and simple when you have Avey-draulics in your shop. Almost immediately, you increase your productivity per man-hour.

The reasons are clear when you see these Avey-draulic features: (1) push-button control; (2) automatic cycle—rapid traverse, feed, and rapid return; (3) jump feed attachment available; (4) multi speeds; (5) variable hydraulic feeds; (6) 2″ to 12″ stroke; (7) 1 or 2 horsepower; (8) single or multiple spindle.

For automatic deep hole drilling, specify Avey's exclusive Torque-matic control. This automatically withdraws the drill for chip clearance—only when necessary—during your drilling operation.

For special applications, Avey-draulics can be mounted at any angle desired.

Write for Bulletin 252.

drilling

Avey

AVEY DIVISION, THE MOTCH & MERRYWEATHER MACHINERY COMPANY, *Box 625, Cincinnati 1, Ohio*

Tube Fittings

All sizes and types of brass fittings listed in 48-page illustrated brass tube fittings catalog; deals with push-pull controls, assembly instructions, data on right and wrong ways for tubing a system, tube fitting data and tools. The Weatherhead Co., Customer Service Dept., 128 W. Washington Blvd., Fort Wayne, Ind. **L-8-21**

Motors

Two informative brochures, 51X8581 on "How To Make a Motor Go . . . and Go, and Go, and Go," and 51X8582 on "How To Take Step Seven," present the stories previously told in 35-mm slide films by these same titles on construction, care, maintenance and best operational procedures of line of motors; well explained by text. Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis. **L-8-22**

Screw Inserts

Comprehensive 8-page specification Bulletin No. 738 on line of Screw-Lock inserts contains selection tables with thread sizes, insert numbers and sizes and complete information on drilling, tapping, gaging and installation; line drawings and photos illustrate proper installation; includes engineering design data, military specifications, classes of fit and assembly proportions. Heli-Coil Corp., Danbury, Conn. **L-8-23**

Hydraulic Power Units

Technical data and specifications on 2,240 different types and models of pumps, pressure switches, hydraulic cylinders and line of accessories offered in 52-page catalog; well illustrated with drawings and charts. Oil-Dyne, Inc., 2117F W. Marquette Rd., Chicago 36, Ill. **L-8-24**

Cutting Tools

Dimensional drawings illustrate 12-page Catalog 257 on high-strength oxide-base cutting tools; includes technical descriptions, table of physical properties; also lists toolholders and dimensions and prices of Stupalox throwaway inserts, solid inserts and unground blanks. Stupalox Div., The Carborundum Co., Latrobe, Pa. **L-8-25**

Spray Coating

Custom designed automatic spray coating equipment discussed and pictured in bulletin which also outlines where such equipment can be used. Eclipse Air Brush Co., 390 Park Ave., Newark, N. J. **L-8-26**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-181

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
61045	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

Send today for the new Nelco catalog—over 700 tools, 700 ways to better production at less cost.

NELCO TOOLS

For that EXTRA Edge in Production!

NELCO TOOL COMPANY, INC., MANCHESTER, CONNECTICUT

STOCK OF OVER 3000 STANDARD TOOLS!

Obtain impartial High Speed Steel, Carbide and Carbide Tipped tooling recommendations from your Brown & Sharpe-NELCO Distributor.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-182

Single Spindle Automatics

Bulletin describes in detail the 1⅝ and 2½ in. Model B automatics emphasizing their construction features, advantages and uses; includes closeup illustrations of features; lists specifications. The Cleveland Automatic Machine Co., Cincinnati 12, Ohio. **L-8-6**

Gage Laboratory

Well illustrated booklet on "Gage Laboratory Instruments and Services" offers instructions, specifications and a layout guide explaining how manufacturing plants may set up individual gage laboratories to meet specific requirements; representing an up-to-date guide to close control of precision measurement as an integral part of plant-wide quality control; the book also describes work and services of the Eli Whitney Metrology Laboratory and illustrates and explains functions of the Accutron electronic amplifier and gaging instruments. Dept. 700, The Sheffield Corp., Dayton 1, Ohio. **L-8-7**

Magnetic Chucks

Line of magnetic chucks, holding devices and accessories described in illustrated 28-page pocket-size Catalog 257; special section incorporates table of constants for use with sine chucks and sine plates. Hanchett Magna-Lock Corp., 383 Maple St., Big Rapids, Mich. **L-8-8**

Metalworking Data

Illustrated 50-page Bulletin 38, "Computations for Metal Working in Presses," contains information and alignment diagrams for computing pressure and sustained work capacity of presses as well as pressure and work requirements of the job the press is to do; also gives information, formulas and charts on blanking and shearing, drawing and reducing, ironing, coining, sizing and forging, and extrusion; includes tables on properties of metals, sheet metal and wire gages and approximate diameters of blanks for shells. E. W. Bliss Co., 1375 Raff Rd., S. W., Canton, Ohio. **L-8-9**

Relays

Information on line of IMP interchangeable and fixed multiple pole heavy-duty relays described in detail in an 8-page booklet for men who sell, specify, install, maintain or use such relays; diagrams, dimensional drawings and photos used to illustrate their versatility. The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn. **L-8-10**

Readers' Viewpoints

. . . over-pin measurements

To the Editor:

With regard to the article, "Exact Method for Computing Over-Pin Measurements for Helical Forms" (Varnum and Johnson, June 1957, pp 116-120), I feel insufficient credit was given to the priority and quality of my developments in this field. The exact over-pin measurement of symmetrical helicoids, regardless of form, is strictly a geometrical problem for which I gave the first concise solution in terms of exact equations. Therefore, the basic Varnum-Johnson equation No. 1 is only a different version of my equation No. 1 in the Van Keuren Handbook No. 36, although derived in a different way.

The Varnum-Johnson approximation is not as accurate as the approximate Vogel Master Formula (Approximation 800, p 200, The Van Keuren Co. Handbook No. 36). For instance, the authors use three trials and errors (called "3 rounds") in a numerical example published in their AGMA Paper 239.03/-1957, while the Vogel Master-Formula needs not a single amendment in the same problem. The comparison shows further that the error of the first approximation of the Varnum-Johnson Formula is 400 times the error of the Vogel Master Formula.

The high initial error in the Varnum-Johnson method has been described as unimportant because, when an electronic computer is used, the machine eliminates the error through repeated calculation. My methods are preferable for most practical calculations, especially if electronic calculating equipment is not available.

WERNER F. VOGEL
Professor of Engineering Mechanics
Wayne State University
Detroit, Mich.

Inasmuch as Dr. Vogel and his work are well known in industry, we felt sufficient acknowledgment was included in the article. Also, since much can be gained by studying a problem from two points of view, we consider publication of this fresh approach a service to our readers.—*ED.*

. . . tool estimating

To the Editor:

We have been putting into use the Tool Construction Estimating Procedure outlined in your May 1956 issue of "The Tool Engineer," and we have run into a couple of questions on which we would appreciate clarification if you can give it to us.

This refers to the inspection time in Chart 19. You will note that in Example 1, the total inspection time allotted is 7.6 hours. This compares with approximately 2.4 hours for all the other operations and seems disproportionate to us.

J. W. ANDERSEN, JR.
President
Monarch Governor Co.
Willow Run, Mich.

Shop equipment and shop conditions vary widely from plant to plant. Consequently, there is considerable variation in the time required to set up or perform specific machining or inspection operations in different plants. The time values for inspection reflect the experience of the author, Mr. Ross E. Quinlan, in many shops over a long period of time. They are not, however, universal standards in any sense and they should be modified to fit specific situations.—*ED.*

. . . ceramic tools

To the Editor:

In the article "Experimenting with Ceramic Applications," March 1957, there was an error on page 97 in the third paragraph under Roughing Operations.

The paragraph indicated that floor-to-floor time could be reduced approximately 115 percent. This, of course, is impossible. If you will check my manuscript you will see that I had indicated a possible floor-to-floor time reduction from 32 minutes to 15 minutes, representing an increase in production of 115 percent.

J. F. ALLEN
Factory Manager
Cameron Iron Works, Inc.
Houston, Tex.

We are extremely sorry for this error.—*ED.*

New LOW COST "SPINOSE" LIVE CENTER BY IDEAL $19.95

This new IDEAL Live Center is especially built to provide:

1. *A Low Cost Live Center* that you never have to repair. After it has paid for itself many times over through long service life you simply replace it at less cost than repair charges on most centers.
2. *Excellent Accuracy* which is insured by twin-row, angular-contact, preloaded ball bearings, handling both radial and thrust loads. Entire nose (point and bearing housing) turns with the work.
3. *Good Load Capacity* comparable to other Live Centers costing more than half again as much.
4. Available in Morse Tapers 1, 2 and 3.

Check these facts with your Distributor and we know that you'll find that the new IDEAL "Spinose" offers more dependable service and all-around advantages than most live centers costing up to 50% more.

CALL YOUR DISTRIBUTOR OR MAIL COUPON TODAY!

For widest range of sizes, types and tapers ask your distributor or write for complete information about the complete line of new Ideal Gold Band Live Centers.

IDEAL INDUSTRIES, INC.
4152-H Park Ave., Sycamore, Illinois
Please send complete information about the new IDEAL "Spinose" Live Centers.
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City_____ Zone____ State_____

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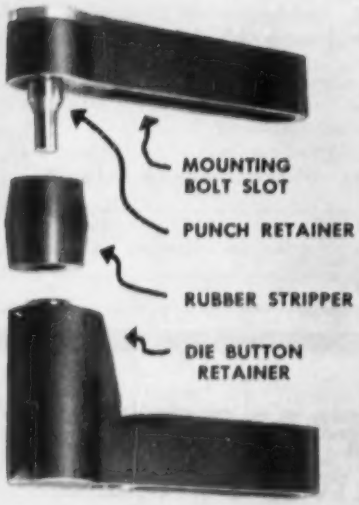
NOW! PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

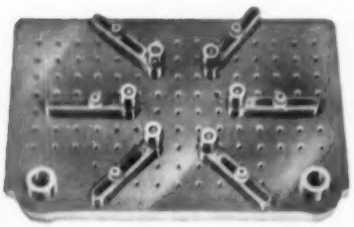


Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

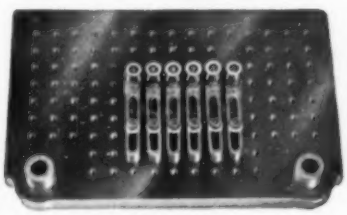
Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

Flex-Mount Retainers are available in many standard sizes.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*



Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.



Use R-B Engineering Service for Your Piercing Problems

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ALLIED PRODUCTS CORPORATION
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FIELD notes

Numerical Control Report Leads Way to Standards Proposal

Two years of intensive study and classification of various types of numerical control or programming now available or under development has resulted in a comprehensive report of the problems of numerical control by the subcommittee for numerical control of the Airframe Manufacturing Equipment Committee of the Aircraft Industries Assn. Intention of the subcommittee was to outline the characteristics of the various systems and to propose national aircraft standards for numerical control equipment as necessary.

To narrow the scope to practical limits, the investigation began with study of the continuous tool path motion, the most complex type of numerical control. Major emphasis was on the point of compatability or interchangeability at the point of original input to the computer or data processing system, and at the point of input to the machine tool itself.

To assure comprehensive coverage, studies were made of systems in the United States, the British Isles and the European area. Contributions to the work were made by Radio, Electronic and Television Manufacturers Assn. and the National Machine Tool Builders Assn.

Under a USAF machine tool program, new numerically controlled machine tools now are being delivered to aircraft companies. Joint industry efforts will prove valuable in introduction of these tools in manufacturing facilities.

In an effort to obtain a greater number of skilled operators, members of St. Louis District of National Screw Machine Products Assn. have been conducting an unusual screw machine training program. Two classes per week were offered by the group—one for Brown & Sharpe automatics and the other for multiple spindle automatics. NSMPA member companies provided financial support and furnished equipment used for the classes which were held at a city technical high school. Plans call for repetition of the same classes next September.

V V V

A design contest open to everyone is being conducted by the Gray Iron Founders' Society to give recognition to designers, engineers and others responsible for a design or redesign of a product to use gray or ductile irons. Entries will be judged on how the design did or could increase efficiency of the product, cost saving, potential commercial importance of its entry to the gray iron industry as a whole, or ingenuity of the design. Top single award, for the contest, which closes on August 20, will be $500. Details are available from Gray Iron Founders' Society, 930 National City, E. 6th Bldg., Cleveland.

new facilities

Open house marked completion of a $1½-million modernization program for Riverside-Alloy Metal Div. of H. K. Porter Co., Inc. at its Riverside, N. J., mill. The program included new rolling and annealing equipment. Improvements in the materials handling system is resulting in a 70 percent cut in rolling mill travel time.

V V V

A facility for production of wings and other aluminum components of the country's giant military and commercial air craft has moved into production at the Reynolds Metals Co. plant at McCook, Ill., near Chicago. The joint Navy-Reynolds project was developed to meet tapered sheet and plate requirements for new designs in aircraft. The original Reynolds plant, built during World War II at a cost of $43-million, has been enlarged and expanded until it presently encompasses 36 buildings under a single roof and covers 60 acres. Five of the buildings now are required to house the new installation which will be named after the late Roy A. Bath who was assistant director of the Industrial Planning Div., Bureau of Aeronautics. The plant will house machine tools specially designed for integration with previously existent Reynolds equipment to provide top fabricating capacity.

V V V

A central aluminum department has been established by the Federated Metals Div. of American Smelting and Refining Co. The department will include the company's present Detroit plant and a new plant now under construction at Alton, Ill.

V V V

Opening of a new, enlarged West Coast facility at 6800 E. Acco St., Los Angeles, is announced by The Bristol Co. It will provide ordering, stocking and shipping facilities for western customers as well as provide large warehouse stocks.

V V V

Wilmington, N. C. has been chosen as the site for Allied-Kennecott Titanium Corp.'s initial multi-million dollar plant to produce titanium forgings and billets. The installation will include a complete laboratory to carry on a program of research and development. When in full operation, the initial unit will employ about 500 people.

V V V

Production has started at the new cold finished bar mill of Jones & Laughlin Steel Corp. The new facilities, located on a 31-acre site in Willimantic, Conn., to serve New England users, provides approximately 90,000 sq ft of production and office space.

V V V

A $6½-million plant for manufacture of grinding wheels will be built by Norton Co. The facility, to be known as Plant 8, has been designed for straight line production of wheels up to 30 in. in diameter. The plant, which will be located parallel to Plant 7 being built this year, is scheduled for completion in mid-1959.

research

A joint research and development program on ceramic coatings for missile application has been instigated by The Bettinger Corp. Goal of the study is a solution to some of the problems of the thermal barrier encountered at elevated temperatures in high-speed flight.

V V V

Battelle Institute has inaugurated a program of research for Wright Air Development Center, Wright-Patterson Air Force Base, to obtain design data and information on modes of failure for rolling-contact bearings operating at

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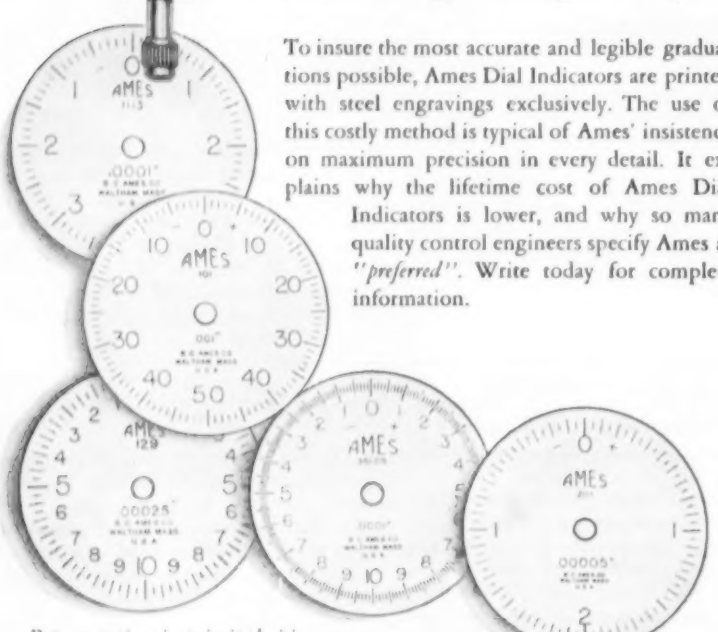
To insure the most accurate and legible graduations possible, Ames Dial Indicators are printed with steel engravings exclusively. The use of this costly method is typical of Ames' insistence on maximum precision in every detail. It explains why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as *"preferred"*. Write today for complete information.



Representatives in principal cities

B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

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temperatures ranging from 300 to 600 F. The present investigation is the first phase of a three part program that is expected to lead to developing new bearings and lubricants and adequate design data for bearings to operate at the higher temperatures.

v v v

Ground has been broken for the new Belock Instrument Corp. engineering center at College Point, Queens, N. Y. This research and development center will augment the company's engineering facilities with its recently established environmental laboratory and mathematical computing department.

moves

Maplewood Companies have moved to new enlarged facilities in Livingston, N. J. The firm, headed by Donald J. Wahler, acts as direct factory representative in the Eastern, Middle Atlantic and Southeastern sections of the company for Packer Machine Co. Mr. Wahler is a member of ASTE's Northern New Jersey chapter.

v v v

New and larger quarters at 46 Sea Cliff Ave., Glen Cove, L. I. have been established by The Maserati Corp. of America.

v v v

Sandvik Steel, Inc. has moved its Detroit office to larger quarters at 14131 Puritan Ave. to provide greater stocking area and to facilitate handling of its Coromant tungsten carbide products and spring steels in that area. James A. Lydick, formerly of the company's Chicago office is district manager for the Detroit area. Mr. Lydick is a member of ASTE's Detroit chapter.

new endeavors

Formation of a Plastics Machinery Div. has been announced by National Automatic Tool Co., Inc. to produce plastics injection molding machines. The division was formed as a result of an extensive two-year program of preparation.

v v v

A line of industrial television equipment has been designed by the Allen B. Du Mont Laboratories, Inc. to meet demands for closed-circuit requirements in industrial plants.

v v v

The Vallecitos Atomic Laboratory, considered the largest privately financed atomic research facility, has been dedicated by the General Electric Co. in

Pleasanton, Calif. According to George White, general manager of the company's Atomic Power Equipment Dept., the facilities are certain to bring great advances in tools and technologies needed to bring unlimited, economical power to the world.

acquisitions

Arwood Precision Casting Corp. is expanding its West Coast operations with the purchase of the Duncan-Rohne Co. and the Malco Metal Products Co., both of North Hollywood, Calif. Duncan-Rohne produces nonferrous investment castings and Malco specializes in machining of castings. Both companies will continue to operate at the North Hollywood location as subsidiaries of Arwood.

V V V

American Smelting and Refining Co. has acquired outstanding stock of Enthone, Inc. in exchange for shares of common stock of ASARCO. Enthone will be operated as a subsidiary.

expansions

ElectroData Div. of Burroughs Corp. has completed a sixfold enlargement of its Pasadena plant. The $4-million plant now provides 250,000 sq ft of area for engineering and production of electronic computers.

V V V

Manufacturing facilities in Detroit for E. F. Houghton & Co. will be more than doubled when present plans are completed for new factory, office and laboratory space adjoining the company's present facilities at Lumpkin Ave. and the Detroit Terminal R.R. The company plans to manufacture in Detroit practically the same oil and chemical specialty line now being made in the Chicago, Philadelphia and San Francisco plants.

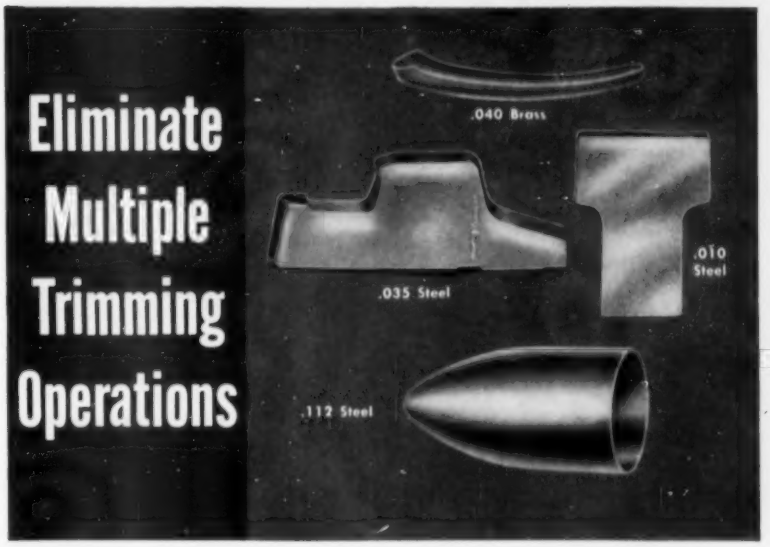
new offices

Crucible Steel Co. of America has opened a new stainless steel sales office and warehouse building at 3400 Malone Dr. in Chamblee, Ga. to serve Atlanta and surrounding areas.

The company also opened an expanded specialty steel warehouse at 4501 W. Cortland St., Chicago.

V V V

An office for Clearing Machine Corp., division of U. S. Industries, Inc., has been established in the Fine Bldg., 1513 Jefferson St., Toledo, Ohio, to provide better service to customers in the Toledo area.



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Costly, time-consuming trimming and notching operations can be done in one operation with a Brehm Trimming Die. Don't worry about stock thickness. Edges will be of full thickness — clean, flat, without burrs or distortion at the trimmed edge.

Other Brehm Die advantages! **Workable Materials** — gold, silver, stainless or mild steel, copper, brass, refrigerator doors, auto bumperbuf zinc, aluminum, fiber, rubber, plastics, **Quantities vary** — Stove or refrigerator doors, auto bumper buffers or typewriter covers, from 264 to 900 per hour. Intermediate parts, where stock and scrap can be blown from the die, about 1350 per hour. **Shapes** — fountain-pen ferrules, artillery cases, watch cases, burial valuts, automotive, kitchen, radio and television accessories and parts. Almost anything you need trimmed.

A Brehm "Shimmy" Trimming Die with angular cams, cuts four ways in one press stroke, handling straight or curved edge contours, with multiple notches and projections. Slow, costly "horn" and "pinch" trimming operations, are eliminated.

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INDICATE A-8-188-1

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Application of Electroerosion to Metalworking

H. Opitz has published an article in *Microtecnic* 1956, Volume 10, No. 5, page 203, on electroerosion in metal-cutting. He divides the spark methods into two fields; namely, those with oscillators and those with circuits generating so-called "saw-tooth" vibration.

The author discusses the influence of the discharge of the spark on the microstructure of the work material and recommends low-frequency sparking for roughing operations and high-frequency methods for finishing.

The microstructure of the surface layer, which undergoes distortion during the roughing operation, is removed during the finishing operation.

The author recommends limiting the wear of the electrode which should not exceed 50 percent of stock removal.

Surface finish may be graphically represented as a function of the spark frequency.

The practical application of spark-erosion to die manufacture and precision work is likewise discussed, as is the production of profiles in heat-treated steel and carbides of a roughness less than 5 micron. In the case of electro-erosive grinding, rotary disks of brass are used for electrodes. The author expects the electroerosion process to be used in finishing of gears in the near future.

Testing of Luster of Highly Polished Surfaces

The surface finish of highly polished surfaces with less than one micron roughness cannot usually be measured by optical or mechanical methods, and can be evaluated only in terms of the surface luster, according to an article by H. Benninghoff in *Metallwaren Industrie und Galvanotechnik*, Volume 48, No. 3, 1957, pages 125-128. The title of the article is "Glanzmessung bei Oberflaechen."

Luster is defined as the sum of all light reflected from the surface, which

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

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Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

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The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

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MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

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may be either sharply or diffusely reflected. The author surveys also the theories of luster and gives a description of an instrument for industrial measurement of surface luster.

The instruments measure the greatest difference between the angle of incident and the angle of reflection at which a sharp mirror image of the surface can still be obtained. This angle is inversely proportional to the surface luster.

French Metal-Cutting Research

Several articles by French authors have been published recently covering metal-cutting research in France. Among them is an article by L. Champetier on "Testing of Cutting Forces by Strain Gages," published in *Machine Outil Francaise*, 1957, Volume 22 (119) under the title "La Mesure des Efforts de Coupe a l'Aide de Jauges de Contrainte."

Another article, by F. Eugene, published in one of the outstanding scientific magazines in France, *Comtes Rendus des Seances de l'Academie des Sciences*, Volume 244 (7) 1957, pages 853-856, deals with a new energy diagram for chip formation. The French title is "Un Noveau Diagramme Energetique de la Formation d'un Copeau Metallique." The author differentiates between work done by elastic deformation and plastic deformation and considers also the so-called coefficient of friction, which is a concept often leading to misinterpretations of metal-cutting results.

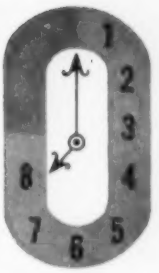
A third article published in the same magazine, Volume 244 (8), pages 1005-7, by F. Eugene, B. Jugue and R. Parran, deals with the effect of the work diameter on tool life in turning operations. The French title is "Influence du Diametre Usine sur la Terme des Outils de Coupe en Tourage."

Measuring of Grinding Forces

Instruments used for measuring grinding forces often affect the stability of the workpiece and the setup and, therefore, do not give data corresponding to actual grinding conditions. G. Pahlitsch and K. E. Lang have therefore used the deflection of the center in the tailstock for testing of grinding forces without changing actual grinding conditions. They have attached gages to the center, both in the direction of the center line of the center and perpendicular to it. They describe their work in the May 1957 issue of *Werkstattstechnik und Maschinenbau* under the title of "Neue Erkenntnisse aus Schnittkraft Messungen beim Aussenrundschleifen."

It was found that oscillations in the forces superimposed on the cutting forces had little effect and were due to unbalance of the grinding wheel, provided that the grinding wheel was

37,440



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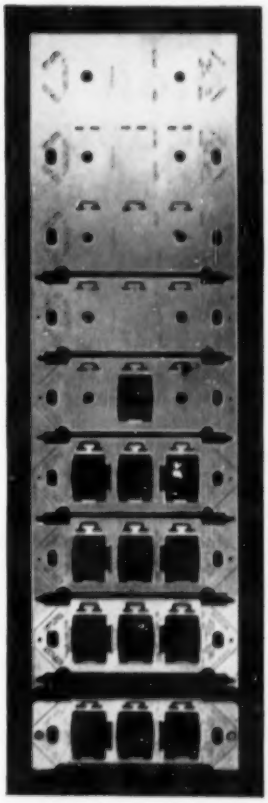

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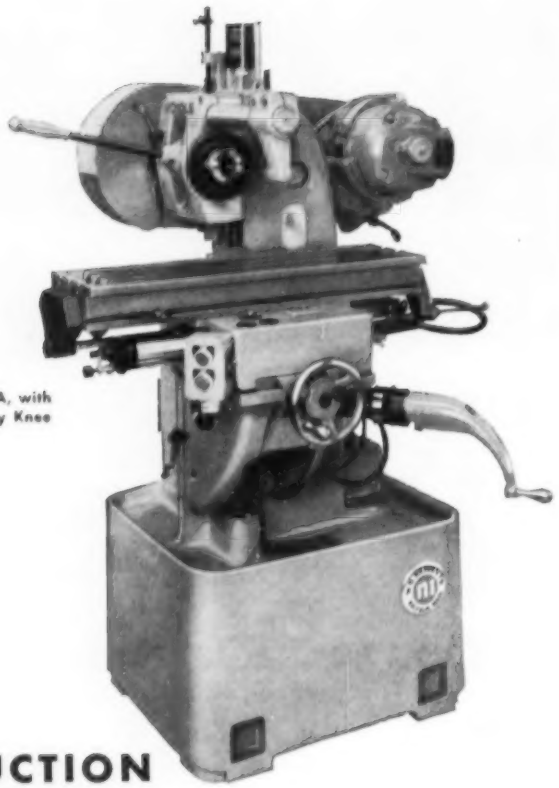

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Nichols Semi-Automatic Millers are equipped with "easy to set up" air-hydraulic table cycles providing rapid approach, variable cutting feed, and rapid return. The operator merely loads and unloads.

In addition to the automatic table feed, the Rise and Fall Spindle head and the Cross Feed may be so equipped. It adds up to a flexible combination of synchronized automatic motions which make Nichols ideal basic millers for modern production lines.

Available in two models—the 8-SA with Heavy Duty Knee and Saddle to support 8½" x 30" table having 14" stroke . . . and the 6-SA with Standard Duty Knee supporting 6¾" x 21" table having 9" stroke.

The Nichols SEMI-AUTOMATIC, and all Nichols Millers, provide unequaled accuracy that *saves cutter costs* and BOOSTS PRODUCTION.

CONDENSED SPECIFICATIONS

	MODELS	
	6-SA	8-SA
Table Working Surface	6¾" x 21"	8½" x 30"
Total Table Stroke	9"	14"
Total Cutting Stroke	5⅜"	14"
Transverse Travel	7"	6"
Vertical Travel—Knee	13½"	11"
Rise and Fall of Spindle	4½"	4½"

Selective Speed Ranges up to 5000 R.P.M.

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dressed at the same speed as that for the cut. Cutting forces increase gradually as the grinding continues and the ratio of the radial to the peripheral cutting force remains surprisingly constant, except in cases where oil is used as a coolant. This ratio varied between 1:6 and 2:4. Reproducibility of the results could be improved—above the average of 92 percent—by dressing with the same diamond and setting it in exactly the same way every time.

Interrupting the grinding process for a short time—say, 3 to 6 minutes—had a definite effect on the cutting forces. They dropped 40 percent and gradually built up again after a certain time of continued grinding had elapsed. The authors explain this finding by the fact that the workpiece and the machine cooled off during the grinding pause and that the effective feed was somewhat reduced.

The authors report also numerous tests with different coolants and oils. The radial force is larger and the peripheral force smaller in the case of cooling with oil than when cooling with emulsions.

Chipless Forming

The term "chipless forming" is being used in Europe to cover metal-forming processes, such as pressing, forging, drawing, stamping, etc. A meeting had been held in Switzerland for Chipless Forming, about which a report is published in *Industrielle Organisation* numbers 2 and 3 1957.

Contributions by O. Kienzle, O. H. C. Messner, A. Brossi, and others cover the field of plastic forming (Bildsame Formung), problems of chipless forming and forging. E. Bickel's paper deals with problems in stamping and A. Dryack's contribution refers to Hydroform and Hydrospin. The application of carbide tools in stamping and drawing operations is discussed by J. Witthoff. He calls attention to the almost forgotten fact that carbide tools were first developed in 1923 for drawing filaments in the manufacturing of electric light bulbs. This field is being given more attention and Witthoff brings a number of examples of small and large cutting dies equipped with carbide edges, of hammers with carbide tips, and of sectional dies for screws. Blanks can be manufactured for the ball-bearings industries with carbide dies and he mentions that up to a million pieces have been produced with one die. Although carbide dies are considerably more expensive than those made of high-speed steel, the advantages in improvements in tool life, reduction of burrs, reduction of down time for tool changes, improvement in surface finish, etc. are great. A cost comparison diagram is included in the article.

technical Shorts

Film Explains Data Processing Possibilities

POTENTIALS of electronic data processing techniques are explained in a new animation film titled "Electronic Computers Improve Management Control." The 15-minute, 16 mm color film uses production control as an example to show uses and advantages of the method. Information is presented in a logical, unadorned, step-by-step fashion so that members of management can understand the possibilities of uses in their own businesses.

The film is available either for rental or sale from the Educational Film Sales Dept., University Extension, University of California, Los Angeles 24, Calif.

* * *

Electron Probe Provides Fast Metal Analysis

MINUTE AREAS of a large sample of metal can be analyzed both quantitatively and qualitatively with an electron probe microanalyzer developed by the *Institut de Recherches de la Siderurgie* of St. Germain, France. The device, invented by Prof. Castaing, and the prototype, built by the French National Aeronautical Research Laboratories, use the principles of the electron microscope and the X-ray spectrograph. With the instrument, a scientist is able to determine quickly and accurately the chemical analysis of the microconstituents of metals and alloys.

Example of results of the research tool's use to date is the now disproved hypotheses concerning variations in concentrations in alloys occurring near crystal boundaries. Many scientists in the past have inferred from the marked micrographic changes observed that there were big variations in chemical compositions at these boundaries. Spot analysis with the microanalyzer has yielded results that indicate that such changes do not occur in most cases. Variations at grain boundaries are generally too small (less than 1 percent), and too localized to show up.

The electron probe microanalyzer comprises four principal components: an electron gun assembly with magnetic lenses to produce the electron beam probe; an optical aiming device which is coaxial with the electron beam and by means of which the spot on the sample to be bombarded may be selected; a mechanism which serves to position the sample in vacuum so the point chosen for analysis is brought under bombardment; and one or more spectrometers for analysis of the X-ray spectrum emitted. Measurement is very rapid and complete analysis is possible in a few minutes.

* * *

New Technique Broadens Horizon For Titanium

INDUSTRY-WIDE production of titanium, zirconium, high-alloy steels and other tough metals came nearer reality with availability to the metal industry of a new furnace pioneered in titanium melting. A culmination of 10 years' experimentation, the unit, called a consumable electrode vacuum remelting furnace, provides a technique

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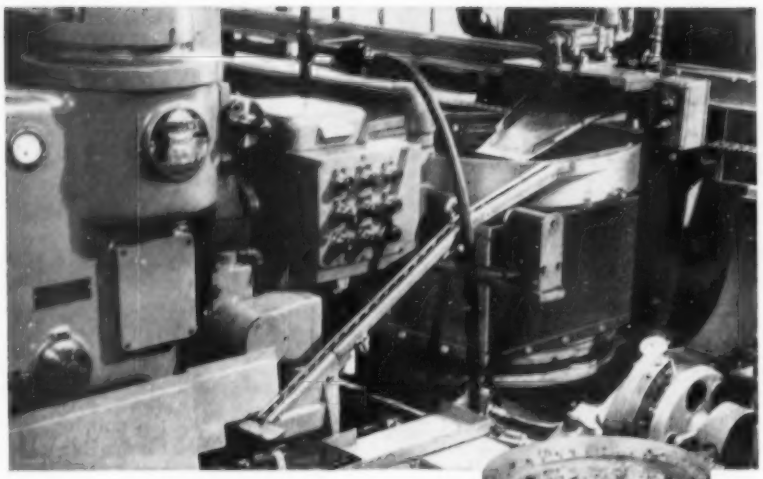

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for low-cost melting of the high performance metals used in building jet aircraft and engines, missiles and atomic reactors. Announcement of the release to industry came from Titanium Metals Corp. of America, jointly owned by Allegheny Ludlum and National Lead Co., which has pioneered the use of large consumable electrode furnaces; Allegheny Ludlum Steel Corp. which uses the special vacuum process for melting of superalloys; and Lectromelt Furnace Div. of McGraw-Edison, which will manufacture and sell the furnace. Under an agreement between the three companies, Lectromelt purchased right to begin immediately to build and sell the furnaces "to such companies as may be licensed for production technique by Allegheny Ludlum or Titanium Metals."

According to Lectromelt's executive vice-president and general manager, F. H. Plank, the furnace is a "major metallurgical breakthrough," which will permit all refractory metals and many precision superalloys to be production melted into large, homogeneous ingots at great speed and relatively low cost.

Advantages attributed by Allegheny Ludlum officials to the new technique for superalloy production are: a higher degree of cleanliness attained through removal of nonmetallic inclusions and excess gases; better compositional homogeneity through freedom from segregation; improved workability and ingot soundness resulting in increased yields; and general improvements in mechanical properties.

* * *

Develop Method For Hardening Saw Rivets

A METHOD for hardening chain saw rivets has been developed by Radio Frequency Co., Inc. Because of the small size of the part, this has been a problem; when induction heating was introduced, not only the large diameter was heated, but the small axial diameter as well. By the newer method, heat is pumped into small objects so fast that parts can be heated to any desired temperature in a stream of water or in oil. Heating under water or oil produces almost an immediate quench. By heating in as little as 1/10 sec. and quenching at the same time, almost a maximum degree of hardness can be obtained. At the same time, the heat is localized—although the large diameter in the case of chain saw rivet is heated to hardening temperature, the axial part receives little or no heat, even though there is only a small differential between the diameters. With the process, it is possible to easily harden 7000 chain saw rivets per hour.

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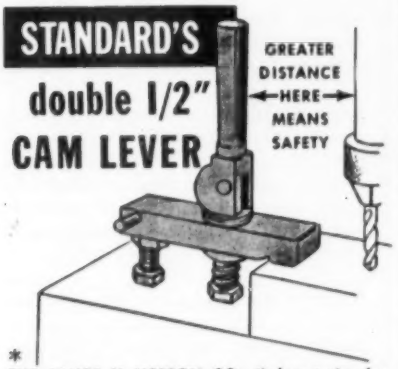
...up to 3,450 lbs. clamping force

STANDARD'S double 1/2" CAM LEVER



*THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."

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who's meeting and where

Aug. 11-15. American Society of Mechanical Engineers. Heat transfer conference, Pennsylvania State University, University Park, Pa. For more data, contact society office, 29 W. 39th St., New York 18, N.Y.

Aug. 12-15. Society of Automotive Engineers. West coast meeting, Olympic Hotel, Seattle, Wash. Direct inquiries to Bruce E. Strasser, SAE public relations manager, 485 Lexington Ave., New York 17, N.Y.

Aug. 20-23. Western Electronic Show and Convention, Cow Palace Auditorium, San Francisco, Calif. For details write Donald E. Larson, Business manager, WESCON, 342 N. LaBrea Ave., Los Angeles, Calif.

Sept. 8-11. National Metal Trades Association. Eastern plant management conference, the Claridge Hotel, Atlantic City, N. J. Write association headquarters, 337 W. Madison St., Chicago 6, Ill. for more information.

Sept. 8-13. American Chemical Society. Fall meeting, New York, N.Y. For further information, contact society office, 1155 Sixteenth St., N.W., Washington, D.C.

Sept. 9-13. Instrument Society of America. 12th annual Instrument Automation conference and exhibit, Cleveland Auditorium, Cleveland, Ohio. Further information on exhibit is available from exhibit manager, Fred J. Tabery, 3443 S. Hill St., Los Angeles, Calif.; details of technical program may be had from Herbert S. Kindler, director of technical programs, ISA, 313 Sixth Ave., Pittsburgh, Pa.

Sept. 9-13. Massachusetts Institute of Technology. Special summer session on precision investment castings

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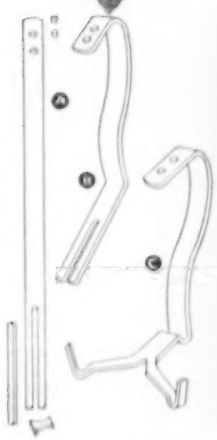
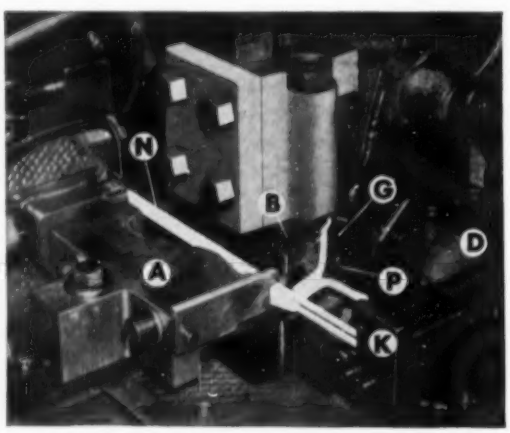


Stand is zinc-plated steel strip 0.05 in. thick by 0.625 in. wide . . . made in steps A, B and C.



Final step in forming Kaz stands on Nilson 4-slide. Feet are spread, bent, crimped (G) with workpiece (P) on centerpost while next piece (N) is being cut off. Stop (K) on right slide (D) backs off after cut and workpiece (P) is wrapped around centerpost by die (A) when finished part is clear.

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for those who have had practical experience in the field; will include lectures, laboratory exercises and demonstrations. Direct inquiries to Office of the Summer Session, Room 7-103, M.I.T., Cambridge 39, Mass.

Sept. 9-20. North Carolina State College of Agriculture and Engineering, University of North Carolina. Two week linear programming short course. Request further information from College Extension Div., N. C. State College, Raleigh, N. C.

Sept. 17-18. Radio-Electronics-Television Manufacturers Association. Symposium on numerical control systems for machine tools, Ambassador Hotel, Los Angeles, Calif. Obtain more facts from association headquarters, 11 W. 42nd St., New York 36, N.Y.

Sept. 17-20. American Die Casting Institute. Annual meeting, Edgewater Beach Hotel, Chicago, Ill. Institute office, 366 Madison Ave., New York 17, N.Y., can supply other facts.

Sept. 22-24. American Machine Tool Distributors Association. Annual meeting, Hotel Cleveland, Cleveland, Ohio. Send inquiries to association office, 1900 Arch St., Philadelphia 3, Pa.

Sept. 23-24. Steel Founders' Society of America. 55th fall meeting. The Homestead, Hot Springs, Va. Details are available from society office, 606 Terminal Tower, Cleveland 13, Ohio.

Sept. 23-25. Standards Engineers Society. Sixth annual meeting, Hotel Commodore, New York, N.Y. Request more information from society office, P. O. Box 281, Camden, N.J.

Sept. 23-26. Association of Iron & Steel Engineers. Annual convention, Penn Sheraton Hotel, Pittsburgh. More facts may be had from association office, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 24-25. Industrial Electronics Symposium, sponsored by Institute of Radio Engineers Professional Group of Industrial Electronics, American Institute of Electrical Engineers and the Chicago sections of IRE and AIEE. Morrison Hotel, Chicago. Send inquiries to E. A. Roberts (IRE) Union Thermoelectric Corp., 2001 Greenleaf St., Evanston, Ill., or H. L. Garbarino (AIEE), Armour Research Foundation of Illinois Institute of Technology, 10 W. 35th St., Chicago 16, Ill.

Sept. 29-Oct. 3. National Screw Machine Products Association. Fall meeting, Broadmoor Hotel, Colorado

Springs, Colo. Write association office, 2860 E. 130th St., Cleveland 20, Ohio for details.

Sept. 30-Oct. 1. Material Handling Institute, Inc. Joint industry fall meetings, Greenbrier, White Sulphur Springs, W. Va. For more facts, contact institute office, One Gateway Center, Pittsburgh 22, Pa.

Oct. 1-5. Society of Automotive Engineers. Aeronautic meeting, aircraft production forum and aircraft engineering display, Ambassador Hotel, Los Angeles, Calif. Society office, 485 Lexington Ave., New York 17, N.Y. can supply details.

Oct. 4-5. American Ceramic Society. Refractories division meeting, Bedford Springs Hotel, Bedford, Pa. More information may be had from society headquarters, 4055 N. High St., Columbus, Ohio.

Oct. 6-9. Electrochemical Society Inc. Fall meeting, Hotel Statler, Buffalo, N.Y. Write to society, 216 W. 102nd St., New York 25, N.Y. for more data.

Oct. 7-9. Illinois Institute of Technology. National electronics conference, cosponsored by two other universities and two technical societies, Hotel Sherman, Chicago, Ill. Send inquiries to Raymond D. Meade, conference coordinator, IIT, 3300 S. Federal St., Chicago 16, Ill.

Oct. 7-9. American Society of Lubrication Engineers and American Society of Mechanical Engineers. Joint lubrication conference, Royal York Hotel, Toronto, Ont. Further information may be obtained from William P. Youngclaus, Jr., administrative secretary, 84 E. Randolph St., Chicago 1, Ill.

Oct. 7-11. American Institute of Electrical Engineers. Fall meeting, Morrison Hotel, Chicago, Ill. For details write 33 W. 39th St., New York 18, N.Y.

Oct. 9-11. Gray Iron Founders' Society Inc. Annual meeting, Drake Hotel, Chicago, Ill. Complete details may be obtained from society office, National City-E. 6th Bldg., Cleveland 14, Ohio.

Nov. 2-8. American Society for Metals. National Metal Exposition and Congress and annual meeting. International Ampitheatre and Palmer House, Chicago, Ill. Second World Metallurgical Congress also will be held in conjunction with this meeting. Society office, 7301 Euclid Ave., Cleveland 3, Ohio, can supply details.

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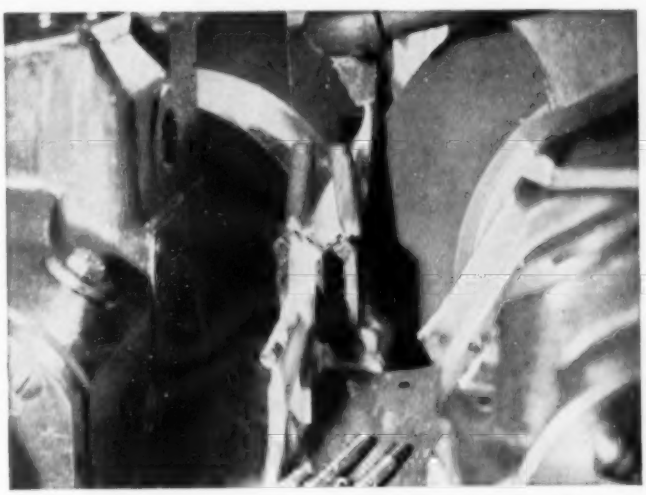

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APPLIED IMAGINATION—*by Alex F. Osborn. Published by Charles Scribner's Sons, 597 5th Ave., New York, N. Y. Price $3.75. 405 pages.*

Only recently has it been generally realized that creativity is teachable. Only recently has it been generally realized that imagiation can be the key to the solution of almost any kind of problem.

In this revised edition, the book was originally published in 1953, the author brings together practically all that is known of the principles and procedures of creative thinking. The new chapters cover "brainstorming"—a method of ideation now being widely employed in industry.

Step by step, this book formulates the practical techniques by which creative imagination can be more productively utilized. Its primary function is to teach the individual to understand and to apply his own innate creativity to all aspects of his personal and vocational life.

ELECTRICITY AND MAGNETISM—*by J. Newton. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Price $10. 623 pages.*

The book starts with two introductory chapters on electrostatics and magnetism. However, these are treated very lightly here and much more in detail later on. A study of current electricity, chapter three, actually is the beginning of detailed information. This order of treatment leads to a more balanced and interesting approach to the subject without making any sacrifice in the logical development.

The many fundamental, but often abstract, concepts which are met within a study of electricity are fully explained. Information of a more technical nature has been included, where appropriate, to assist the reader to appreciate the practical aspects of electrical science.

ENCYCLOPEDIA OF CHEMISTRY—*Edited by George L. Clark and G. G. Hawley. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $19.50. 1060 pages.*

This is a complete, multiauthor, one-volume encyclopedia centered around the subject of chemistry and including over 20 different sciences that border on chemistry. The information, concise and authoritative, is designed for the needs of chemists, engineers and scientific workers in all fields.

Over 500 contributors from science and industry have written the articles of this handy volume which portrays and integrates the many facets of chemistry. In almost every case, the author of each article is not only an internationally recognized authority but also a capable writer.

MANUFACTURING PROCESSES, 4TH ED.—*by Myron L. Begeman. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price $8. 624 pages.*

The purpose of this book is to provide students and engineers a text which will give not only a basic knowledge of the materials and processes in industry, but also information used in manufacturing operations. It can be useful to the practicing engineer and will aid the industrial worker who wishes to review some special phase of metal processing.

Less descriptive than previous editions, the book places greater stress on principles and materials. Advantages and disadvantages of the various processes are examined and discussed.

New topics discussed include electroforming, metal-coating processes, electrospark machining, ultrasonic machining and automation.

Each topic is dealt with concisely. Line drawings, rather than photographs, have been used for a clearer visualization of each machine process and the tables have been chosen for the greatest usefulness and for future reference.

PLASTIC TOOLING BIBLIOGRAPHY *(with abstracts)—by Orville D. Lascoe, Professor of Industrial Engineering, Purdue University. Copies may be purchased from the American Society of Tool Engineers, 10700 Puritan Ave., Detroit, Mich.*

This Research Report #5, contains a bibliography of material related to plastic tooling. The project co-sponsored by the ASTE Research Fund, Bakelite Co., Ciba Co., Inc., The Marblette Corp. and Shell Chemical Co., should prove of interest to those working with plastics or in allied fields.

The report is not permanently bound and is priced $.75 for ASTE members and $1.50 for nonmembers.

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Tech Digests

How to plan automation

By George W. Jernstedt
Dir. of Manufacturing Engineering
Westinghouse Electric Corp.
Pittsburgh, Pa.

IN THIS INDUSTRY a wide variety of products are manufactured. They vary not only in number per day but in weight and size. Tiny flash bulbs are made at the rate of hundreds of thousands per day. One machine makes a half million bases per day. On the other end of the scale are giant turbo generators produced at a rate of a small fraction of one unit per day.

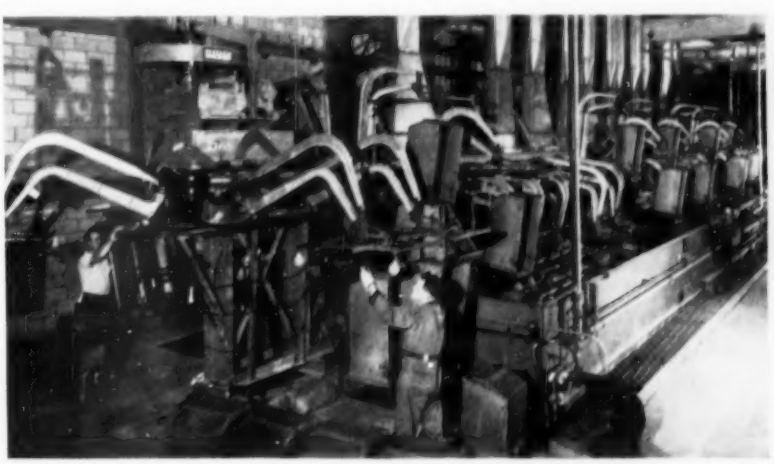
A headquarters manufacturing laboratory was established to help divisions increase their automation in the plant. In order that this laboratory fit into the over-all plan of the divisions a set of operating policies have been set up. They are:

1. Interest divisions in establishing and maintaining their own manufacturing development programs.
2. Employ the services of vendors as much as feasible.
3. Disseminate information to the divisions using such tools as seminars, reports, internal publications and committee organizations.
4. Establish forward looking manufacturing method and equipment development programs.

One of the main items stressed from the headquarters standpoint is the planning function. The place to start automation in the manufacturing plant is with the planning group. If such a group does not exist in the formal organization of the plant, it should be formed to include representation from such functions as manufacturing engineering, manufacturing laboratory or process development, plant layout, appropriations, methods engineers and tool or equipment design. The manufacturing planning group must be coordinated with product engineering and the other manufacturing department.

Wherever feasible and economical automation equipment is purchased. A good example is a standard transfer machine to machine air conditioning compressor heads. Also purchased are special purpose machines like the standard welding machine modified by the supplier to fit the product. Here food compartments are made by seam welding a stamped sheet metal top piece and bottom piece to a stamped and formed sheet metal skirt or wrapper that makes the sides and back. The welding is sequenced automatically. The finished food compartments are taken to a degreasing, pickling, and metal preparation machine by an overhead conveyor above the operater's head. All cleaning and pickling operations including the nickel immersion coating preparatory to enamelling is done automatically on a metalfinishing machine.

In special cases in-line automatic assembly machines employ standard indexing bases. One machine produces six different styles of arc chutes for switches. Another such machine in process of construction assembles and calibrates motor overload protection thermostats. This particular machine will have almost all the microswitches or limit switches replaced with static switches having no moving parts, tubes or relays. The limit switch has pre-



Metal finishing machine automatically performs cleaning, pickling and nickel immersion coating prior to enamelling. Part is fabricated food compartment.

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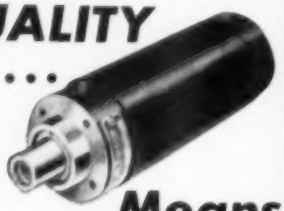

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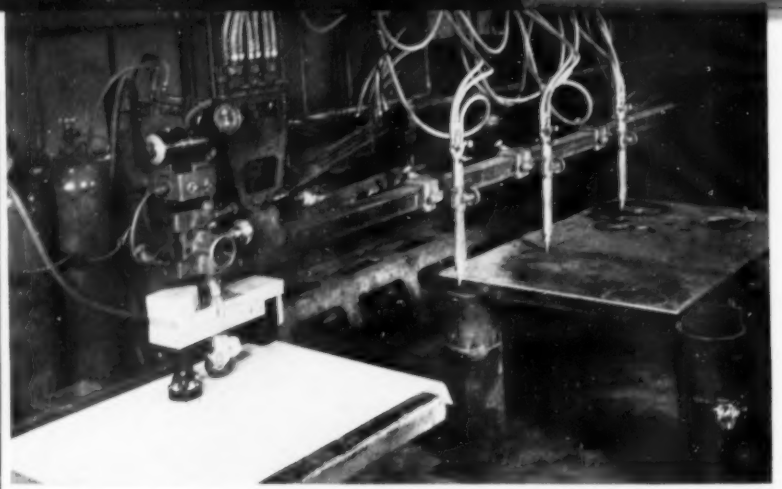

Linetracer applied to multiple torch cutting operation represents a simple and practical application of automation. This machine follows a pencil line, without magnetic requirements. The system is accurate, relatively low cost and affords worth-while economic advantages.

sented several problems in reliability.

As automation moves into the plants some of the inconvenient and difficult to mechanize processing steps are being eliminated. For example, fluxing for soldering and tinning appears to be on the way out with the advent of ultrasonics.

Computers will eventually find economical advantage in manufacturing operations. A simple quality control computer controls an arc chute in-line assembly machine. It can be set to govern the percentage of rejects but will shut the machine down before this quantity is reached if a selected number of rejects appear in sequence. The unit is constructed with static components for low maintenance.

In order to improve the automation development on some of the intricate hand assembly work; the first machine will assemble medium sized transformer coils and cores. This is a tedious and heavy operation. In the old process of hand assembly occasionally some of the parts are distorted or otherwise spoiled and must be replaced.

Metals joining is a particularly fertile field for automation. Mechanizing many welding processes is feasible. An example is automatic capacitor can welding. The operator inserts the capacitor can and presses the button. All the mechanical and electrical operations are interconnected, automatically sequenced, tapered and otherwise controlled to produce a uniform weld, even around corners. This is accomplished at higher speeds and higher over-all quality than ever produced manually.

From a paper given at the National Materials Handling Exposition and Conference, American Material Handling Society, 341 Madison Ave., New York 17, N. Y.

▼ ▼ ▼

Training Engineers for Management

By F. R. Kappel, President
The American Telephone and Telegraph Co.
New York, N. Y.

In this dynamic and expanding world the competent engineer has to lead a dynamic and expanding life. In my judgment there is simply no room left for any routine approaches to engineering, or for standing still. The engineer has to grow and change with the times, and constantly equip himself to handle new problems. He has to nourish his mind and broaden his outlook to make sure that neither gets obsolete. And, at all times, he has to look ahead.

Obviously needed are creative imagination ability to take on new assignments, and selective judgment. The growing tendency in the schools to concentrate on fundamentals is helpful because the first need is to develop the basic mental equipment. There remains to industry the great responsibility, not only to provide first rate technical training, but also to make sure that the able engineer never gets locked in his own technical closet.

To be sure, he always remains an engineer, with a sound grasp of engineering fundamentals that never grow obsolete. But he also becomes some-

thing more. As he applies ever-changing arts he is also thoughtful of their effects. He gains and uses knowledge of marketing and finance. He interprets between designer and salesman. He perceives and understands the general needs and particular problems of other people, whether he holds a supervisory position or not.

The communication development training program (CDT) began in 1948 in response to the need to prepare graduate engineers for research and development work. The program extends over three years with about half the time in classroom work. More than a hundred men enter this each year.

Starting in 1956 a small number of CDT students are being awarded fellowships to allow them to study for their doctorates. While doing this, they continue as employees at full salary.

About 140 professional members of the laboratories are doing graduate work at nearby universities during part of their working hours, with tuition refunded by the laboratories. For technical aides and engineers, the laboratories also conduct numerous out-of-hour courses. Participation is voluntary with some 1500 registrations this year. In addition, a monthly lecture program has an average attendance of about 700. The operating companies of the Bell System are also moving to broaden their training. Throughout the System, engineers are also participating fully in management development programs. The company wants engineers and other management people to think out problems together.

Opportunities for Advancement

Over the next 10 years more than 80,000 Bell System people—engineers included—will be moving into new positions in management. New art and new applications will bring new convenience in service and now forms of service. With people changing, management changing, technology changing, and service changing, it is unthinkable not to use every means to improve competence and understanding.

Through intelligent and concerted effort will be developed three-dimensional engineers. The first dimension is what is developed in college. That shows how to move in a straight line in a particular field.

The second dimension is in continued training and self-study, that broadens a man—or a woman—and keeps him up to date with technological changes so he can solve problems in broad areas

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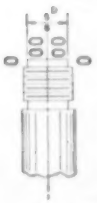
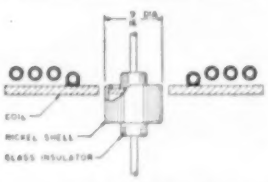


Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.

REMOVING
RUBBER FROM STEEL

Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.



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Spark Gap Converters from 2 kw to 30 kw.

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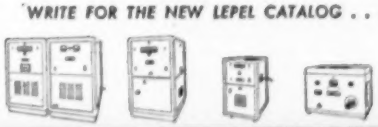

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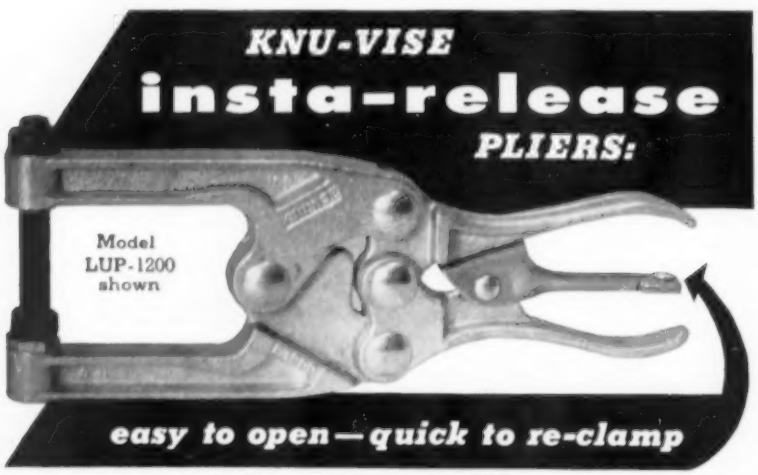
and new areas of engineering.

The third dimension is the height that comes from the mixing and mingling of engineering and management ideas, so that the engineer's understanding of the problems and requirements of the business makes him more effective in the business. This understanding comes not only from study but also from shoulder-to-shoulder association and contact and interaction between engineering. This third dimension is needed everywhere—so they will have a volume effect on the business. If engineering is to be solid, it has got to have this volume. Industry can contribute much to the second and third dimensions.

As the need for technology increases further the need for engineers in management will likewise continue to increase. Engineers must grow. No one else can do it for them.

Training and education both are essential, but what they add up to in the end is only the soil to grow in. The challenge to engineers today is that they should deliberately work to fill out all the height, all the depth, and all the breadth they can reach. Along with this, industry is equally challenged to give able engineers full opportunity to live and work and think and create in all three dimensions. For this is the kind of engineering influence and leadership needed.

From an address at the 1957 general session of the American Institute of Electrical Engineers, 33 W. 39th St., New York, N. Y.



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Keys To Better Technical Writing

By John L. Kent

Chief, Editorial Bureau
Consolidated Electro-Dynamics Corp.
Pasadena, Calif.

Scientific advances in all fields require technical information and ideas. Unfortunately, few technically trained people can communicate; that is, with the least effort and greatest result. The highly desirable characteristics which they possess that make them good engineers often make them poor writers.

Editors compain that engineers don't know how to write for their readers. Research directors and company administrators also complain that engineers write poor reports.

The engineer's inability is chiefly due to a lack of knowledge. Unfortunately, this knowledge is not readily available. Refresher courses are few and textbooks are long on theory and short on practical help.

A number of usable, practical bits of advice on how to produce writing efficiently have come out of the trials and tribulations of engineers in the past. Generally, the engineer-writer succeeds almost directly in proportion to his adoption of methods used by professional writers.

Four keys to this approach are:

1. Plan and outline
2. Consider the reader
3. Use short sentences and simple words
4. Be critical

A most important "key" is proper planning. Whether it's an article, report or other technical manuscript, an outline and a period of planning are necessary. Every type of writing has its own outline—its particular format.

A report, for example, is a specialized form of expository writing whose order should be apparent through section headings, subheadings, numbered paragraphs and other means. Reports have become standardized and usually include a title page, an abstract, a table of contents, the body (including introduction, discussion, and conclusion) and the recommendations.

An article, too, has a form. It is not a cutdown report. It's a distinct piece of writing.

A technical article does not need be as complete and detailed as a report. Details of minor importance can be omitted. Selective omission is one of the major differences between the report and the article.

The second key to technical writing improvement is to consider the reader. The writer must consider his typical reader and write for him. Another important thing is to give reader informa-

tion. The technical reader is a serious person who reads for information rather than entertainment. Further, one should tell his story quickly. The typical reader is busy. Give him summary type reports. Don't expand—condense.

Also vital is to make the material easy to read. Two ways to do this are: use short words; use short sentences. The short sentence is the greatest aid to readable writing. In addition it helps prevent grammatical errors.

Be clear, concise, coherent. Clear writing can be obtained chiefly through simplicity and precision. Conciseness can be obtained by planning and outlining and by the use of simple grammatical construction. Coherence results from proper planning and use of transitions, known to grammarians as conjunctions.

Brevity Aids Reader

The short sentence is probably the greatest help to understandable writing. It permits pacing of ideas. Ideally, each sentence should be limited to one thought. Sometimes, however, simple sentences are incapable of communicating complete thoughts.

As sentences become longer, relationships between words become less clear. Such sentences are harder to understand and may require rereading. They often lead to errors in grammar.

There's another reason why technical people in particular should write short sentences. In ordinary writing, shorter words can be substituted to help the reader understand. Generally, technical words cannot be simplified. Short sentences can compensate for this.

Being critical of completed writing is the fourth key to good presentation. This involves more than a mere reading over and insertion of a comma or the substitution of a better word. It should be a systematic check of the manuscript.

Examination of engineers' writing reveals several failings which are often repeated. These include failure to paragraph, use of jargon and cliches, wordiness, and lack of sell.

The lack of "sell"—the ability to "put over" a story—is evident in both articles and reports.

To get good presentation one must not only get facts down briefly, but so arrange them that the reader can sense that back of the arrangement and presentation was an engineer who knew what he was talking about.

From a talk given before the L.A. section of American Society of Lubrication Engineers, 343 S. Dearborn St., Chicago 4, Ill.

▼ ▼ ▼

Do you need better ways to strip paint?

When tough finishes resist your present stripping methods, you may need help on some of these problems:

1 How to strip oil-base paints . . . synthetic enamels . . . alkali-resistant plastics . . . resin-base paints . . . japans . . . wrinkle finishes . . . nitrocellulose lacquers . . . alkyds . . . phenolics . . . ureas.

2 How to strip zinc chromate primers without etching aluminum.

3 How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without doing their work.

4 How to strip metal parts that are too large to be soaked in tanks.

5 How to strip paint, pigment residues, phosphate coatings and rust in one operation.

6 How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.

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Production Advances in Nondestructive Testing

Symposium from Nondestructive Testing Session

Western Metal Congress
Los Angeles, Calif.

Because nondestructive testing has ability to discriminate between desirable and defective material, it is saving lives, time and money.

Previously, industrial X-ray pioneers had a continual struggle to prove that this tool could be used as a means of production inspection. Industrial radiography now is at the stage where it has a wide wealth of knowledge and capable tools to work with.

The application of X-ray thickness gages to automatic thickness control has placed greater emphasis than ever on simplicity and reliability of the equipment. The gaging system is substantially simpler than previously available gaging systems and retains high performance and flexibility.

Two X-ray beams are obtained from a single X-ray tube. One beam passes through the material being gaged; the other through a wedge at the position where its thickness is the same as that of the material. Any change in material thickness causes a difference in signal from the two detectors.

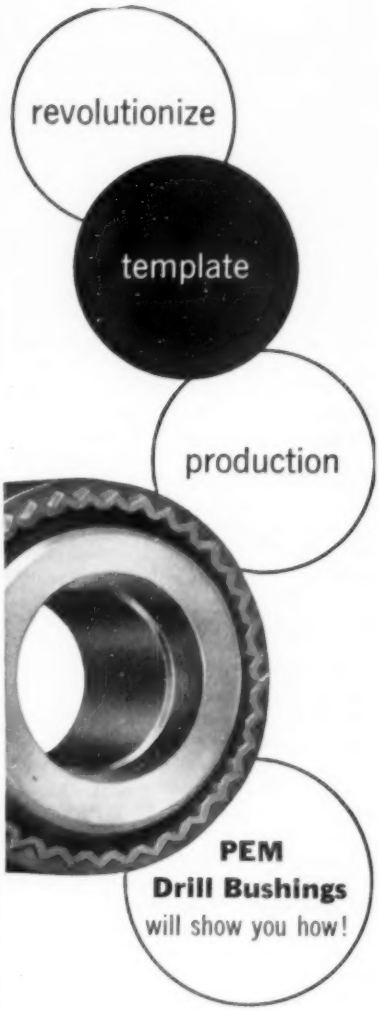
TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

A number of attempts were made to make ultrasonic flaw testing automatic and this has been accomplished with simple shapes and repetitive testing.

A second approach was the so-called shadowgraphs. These generally consisted of a transducer which sent out ultrasonic waves, a tank in which the material under test could be immersed, and an indicator.

It is now possible to successfully use clean tap water plus certain additives as a vehicle for magnetic particle inspection. The sensitivity produced by the water solution is equal to that produced by light oil solutions. Rust inhibiting properties of the solution used have proved effective. Definitive material cost reductions will be realized by using water solutions. Safety is increased through reduction of fire and health hazards of oils.

Radioactivity density gages, five years



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INDICATE A-8-204-2

ago considered an oddity, now have found excellent acceptance in industry. They have a number of advantages over conventional measuring systems. They are used for measuring the level of liquids, slurries and solids.

These gages depend for their operation on the fact that gamma radiation is absorbed as it passes through the various materials and that this absorption is a function of the density of the material. Generally, the sources of gamma radiation are cesium-137 and cobalt-60.

Introduction of atomic energy has made it possible to produce radioisotopes at low cost for nondestructive inspection of metals. Isotopes have advantages over radio. One is that they have various output in energy of gamma rays and gamma ray dosage rates.

These are some of the developments which indicate trends in nondestructive testing. They are typical of applications in metalworking and foreshadow greater use of this technique in production.

From a session at the 10th Western Metal Congress, Los Angeles, Calif., March 1957, sponsored by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

▼ ▼ ▼

Diagnostic Tools For Automatic Equipment

By Kirk E. Birrell
Project Engineer
The Autometrology Div.
The Sheffield Corp.
Dayton, Ohio

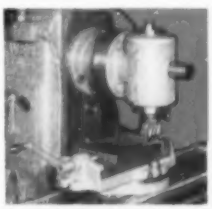
Both users and builders of automatic machine tools, transfer machines, gages, and assembly machines are aware of the problems involved in installing this equipment so that it is equal to production requirements. Pressing problems involve seeing that this equipment continues to operate at proper efficiency. Further, problems necessitate the development of new methods and tools for "debugging" new equipment and for maintaining it after it is once set up.

One such tool is the Monitorecord sequence-time recorder recently developed as a specific means for timing accurately and recording graphically the many operational events making up a repetitive machine cycle. This instrument was designed to supersede the now inadequate "eyeball" and "stop watch" methods of timing automated machinery.

After its introduction, in the pioneering days of automatic transfer-type gages, it had an opportunity to illustrate its potential for the purchaser of a certain machine who had been promised a production rate of 1800 pieces per hour. The best efforts of experienced toolmakers failed to operate the machine at a rate better than 1500 parts per hour. Analysis of a time chart made available by use of this instrument pinpointed specific adjustments which, when made, allowed the required production rate to be gaged with ease.

Another potential application in the domain of automation is that of process inspection for size. Monitoring automatically, the instrument records intolerance or out-of-tolerance parts for a number of dimensions. Such a record can do much to eliminate requirements for further audits of quality by inspectors who rely on master gages. These

Automatic machine cycle is analyzed by comparing operation with master coded chart of optimum cycle. Fourteen channels permit detailed analysis of machine time cycle, presenting time data in bar chart form.



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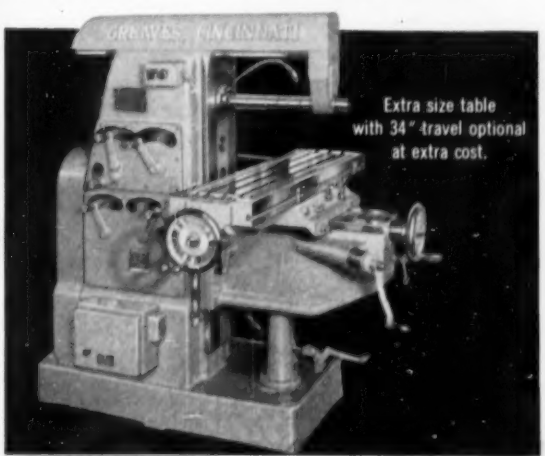

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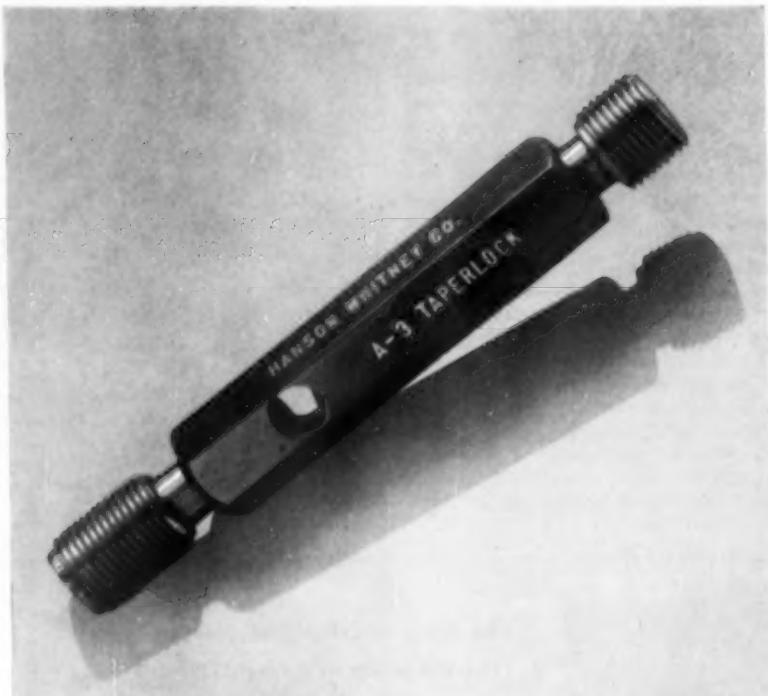

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inspectors can then operate in the capacity of "meter readers."

Generally, then, the sequence-time recorder has many areas in which it can be used advantageously for machine timing, beyond the capabilities of human observation. It can fill an important role in setup and maintenance of automatic production lines of today and tomorrow.

From a paper given at the 1957 Annual Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corp., 401 Liberty Ave., Pittsburgh 30, Pa.

▼ ▼ ▼

Vinyl-Clad Steel— A New Material

By Glenn Edward Wintermute

Arvin Industries, Inc.
Columbus, Ind.

Vinyl-clad steel offers the metal fabricator a new material. It combines the beauty and durability of vinyl plastic with the strength and ease of formability of steel.

The process developed to produce this lamination of vinyl to steel is unusual. Four of the major advantages of this new metal coating method are:

1. The metal is coated continuously in the flat
2. Vinyl film that has been previously calendered, printed and embossed can be used
3. The vinyl film is not damaged in either appearance or properties by the process
4. The bond between the vinyl and the steel has sufficient integrity to withstand subsequent punching, drawing and forming operations.

Some fundamental laboratory work was conducted to establish processing procedures, determine limits of variables and gather information for the design of a pilot plant. The pilot plant proved that the process was adaptable to continuous operation at high production speeds and low operating costs.

The vinyl-metal laminate produced by the pilot plant was fabricated into numerous articles without damage to the vinyl coating. The coating exhibited the excellent resistance toward exposure, stains, and physical abuse that is characteristic of vinyl. Vinyl-clad metal laminates possess some limitations in fabricating and in service. These limitations need to be recognized.

From a presentation at the Jan. 1957 annual technical conference (St. Louis) of the Society of Plastics Engineers, Inc., 34 E. Putnam Ave., Greenwich, Conn.

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This Program includes three tested plans for leasing new Norton grinding or lapping machines. Each plan offers you the option of terminating the lease or purchasing the equipment after a stated period. Particular advantages of the Lease Program are: (1) You can acquire needed machines for just the period in which you can use them profitably, thus eliminating the obsolescence factor; (2) You can make a thorough trial of equipment without going to the expense of actual purchase, unless you decide to do so later.

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Norton machines available under the Purchase Financing Plan and Lease Program include a broad selection of the most popular types of grinders and lappers. Special arrangements will be considered whenever other Norton machines are required.

For Further Information

see your Norton Representative. He will be glad to discuss the relative merits of each Norton financing method, with regard to your particular requirements. He will also give you complete details of the various machines available and advise you as to which are best suited to your production needs. Or you can write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

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Left to right: light-duty angle screw driver; light-duty angle nut setter; heavy-duty angle screw driver; heavy-duty angle nut setter.

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for close-quarter

screw driving and nut setting

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Keller Tool No. 2 air motors—*with increased speed, increased power, low noise level and low maintenance*—power both the 12G-2 series screw drivers and the 16G-2 series nut setters.

Ask your Gardner-Denver representative for a demonstration of the new Keller Tool No. 2 air drivers and their versatile attachments . . . or write for details.

ENGINEERING FORESIGHT—PROVED ON THE JOB
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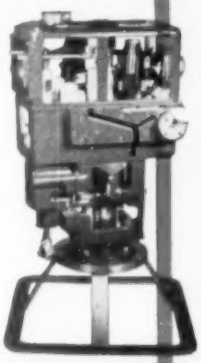
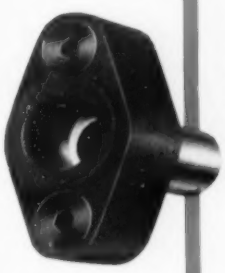
Gardner-Denver Company, Quincy, Illinois

5 practical ways to "streamline"

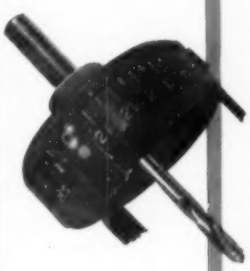
...without sacrificing fastening strength



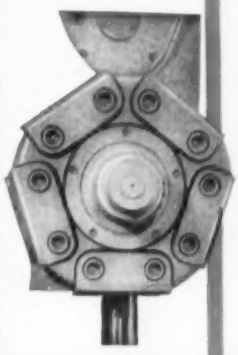
1. Counterbored holes are the simplest approach to flush surfaces using standard socket cap screws. The advantage of specifying genuine Allen O Head Cap Screws is the greater strength of Allenoy steel . . . you can use smaller sizes for closer spacing and reduced weight. Call on Allen, too, for *very large* socket-head, precision cap screws — up to 2½ inch diameter.



2. Countersinking enables you to get absolutely smooth external surfaces using Allen O Flat Head Cap Screws. Allen O Cap Screws feature the exclusive Leader Point which makes screw starting easier and guards against thread damage.



3. Button Head Cap Screws produce snag-free unbroken surfaces where countersinking is impractical. Button-head hex sockets are necessarily shallow. In genuine Allen O Button-Head Cap Screws, sockets are cold forged without broaching, in extra strength Allenoy steel . . . essential protection against stripping the sockets under high torque pressure.



4. A ready made hole tapped in forged steel solves many a design problem. It's called the Allenut. It can be anchored in soft material to assure durable threading, or recessed to permit tightening with an Allen Hex Key.

5. Bright finish, or rust and corrosion resistance call for Allen O Stainless Steel Cap Screws. They are standard stocked items (both NF & NC threads) readily available in a wide range of sizes from Allen Distributors.

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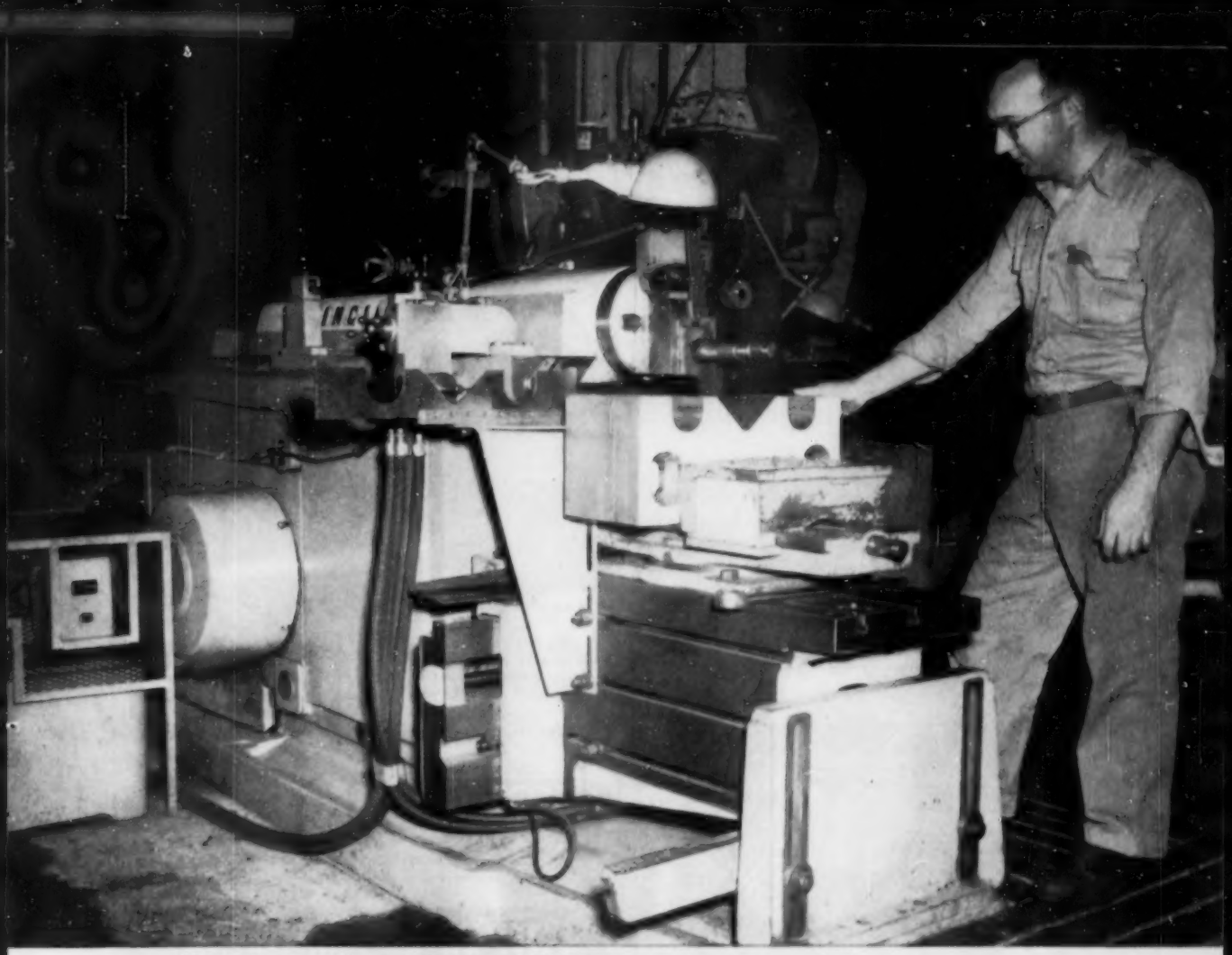

Photograph courtesy of Heppenstall Company, Pittsburgh 1, Pa.

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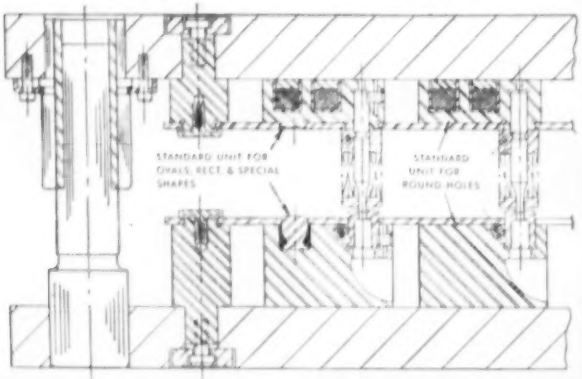

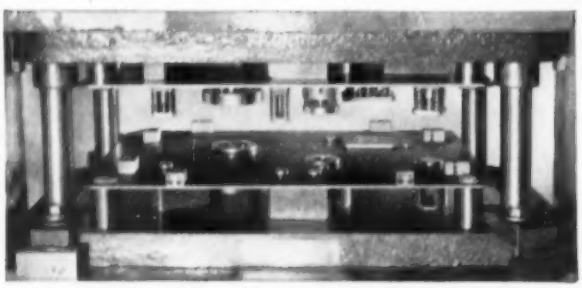

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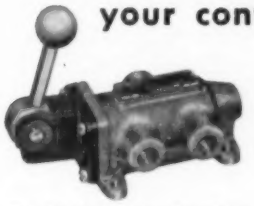

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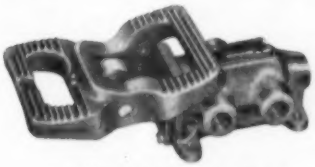
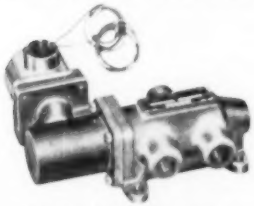


Foot-Operated Four-Way Valve

Pilot-Operated Valve



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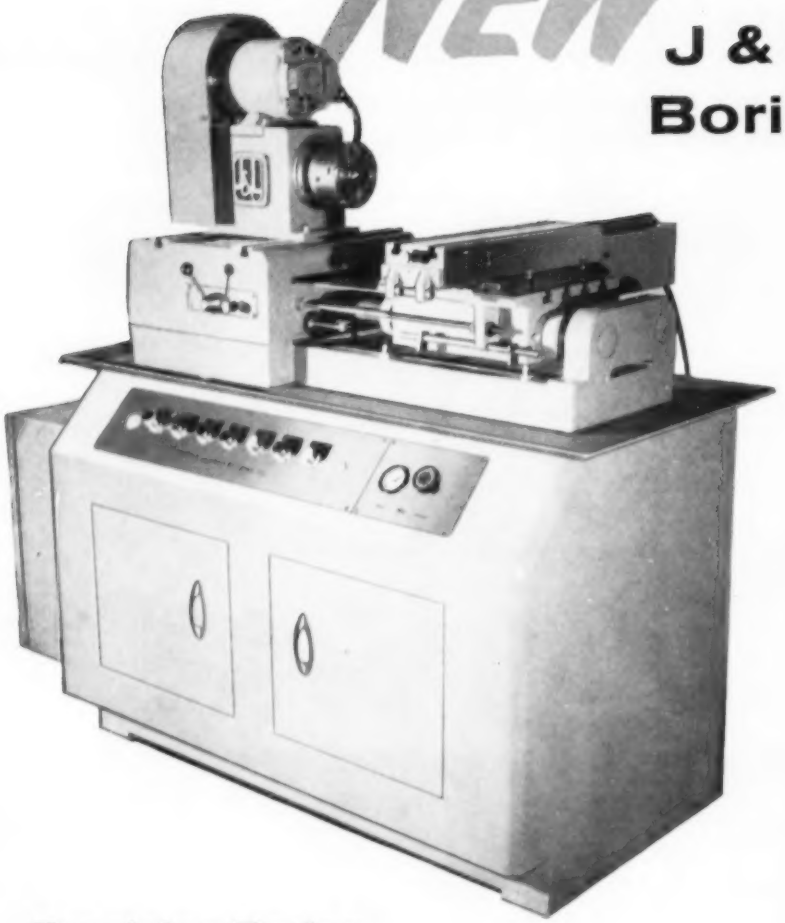

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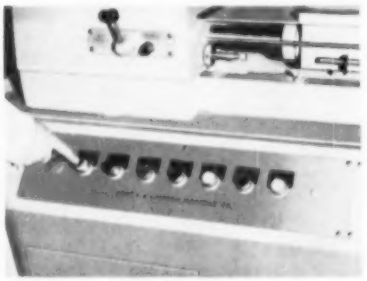
Base will accommodate *two spindles* for rough and finish boring, simultaneous facing and boring, or for boring two holes at once.

Work table feed is actuated with variable hydraulic check unit. Adjustable stops are easily set for length of rapid traverse and feed strokes.



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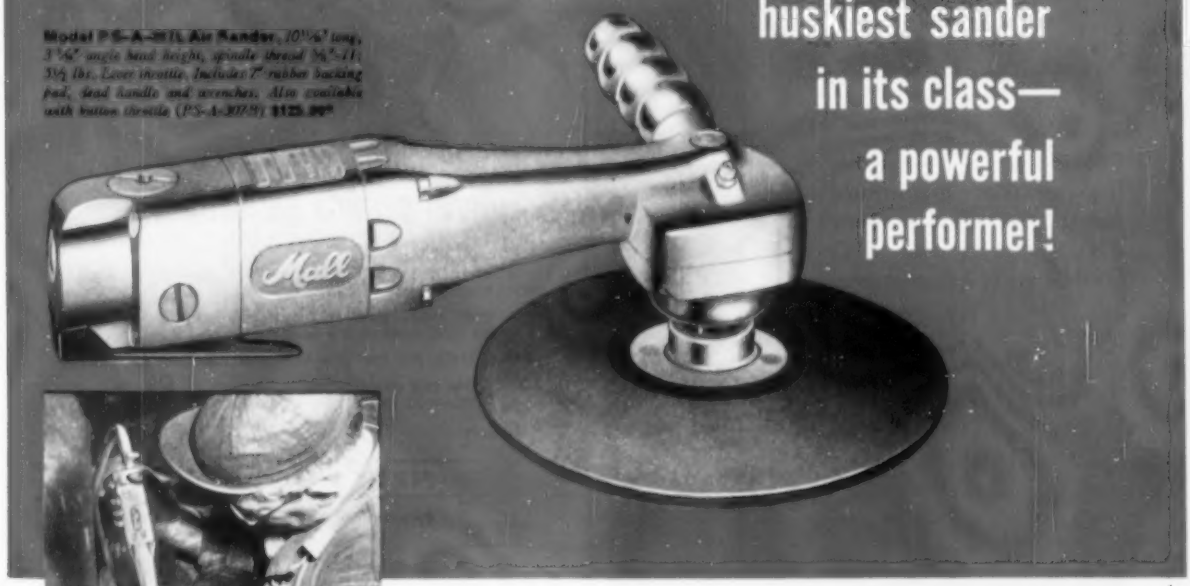

Model PS-A-307L Air Sander, 10⅛" long, 3¼" angle head height, spindle thread ⅝"-11; 5½ lbs. Lever throttle. Includes 7" rubber backing pad, dead handle and wrenches. Also available with button throttle (PS-A-307S) **$125.00***

huskiest sander in its class— a powerful performer!

PS-A-307L Air Sander being used to prepare metal for painting.

Here is the perfect angle air sander for both light and medium metal removal jobs. With its power and its speed—5900 rpm.—it can do the "in-between" jobs as well as a heavy duty sander...and you don't pay for power you don't use! Though light in weight, it is the huskiest sander in its class! And its light weight—only 5½ pounds—helps reduce fatigue.

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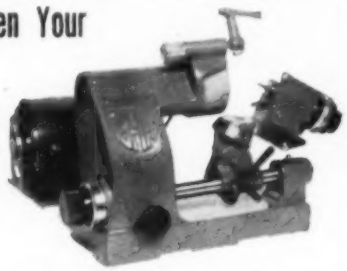

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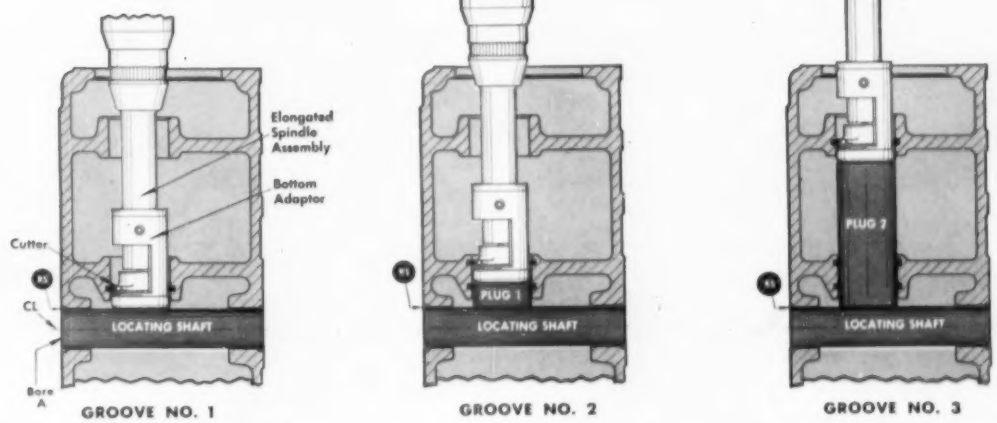
3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1 GROOVE NO. 2 GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

Groove No. 1: A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

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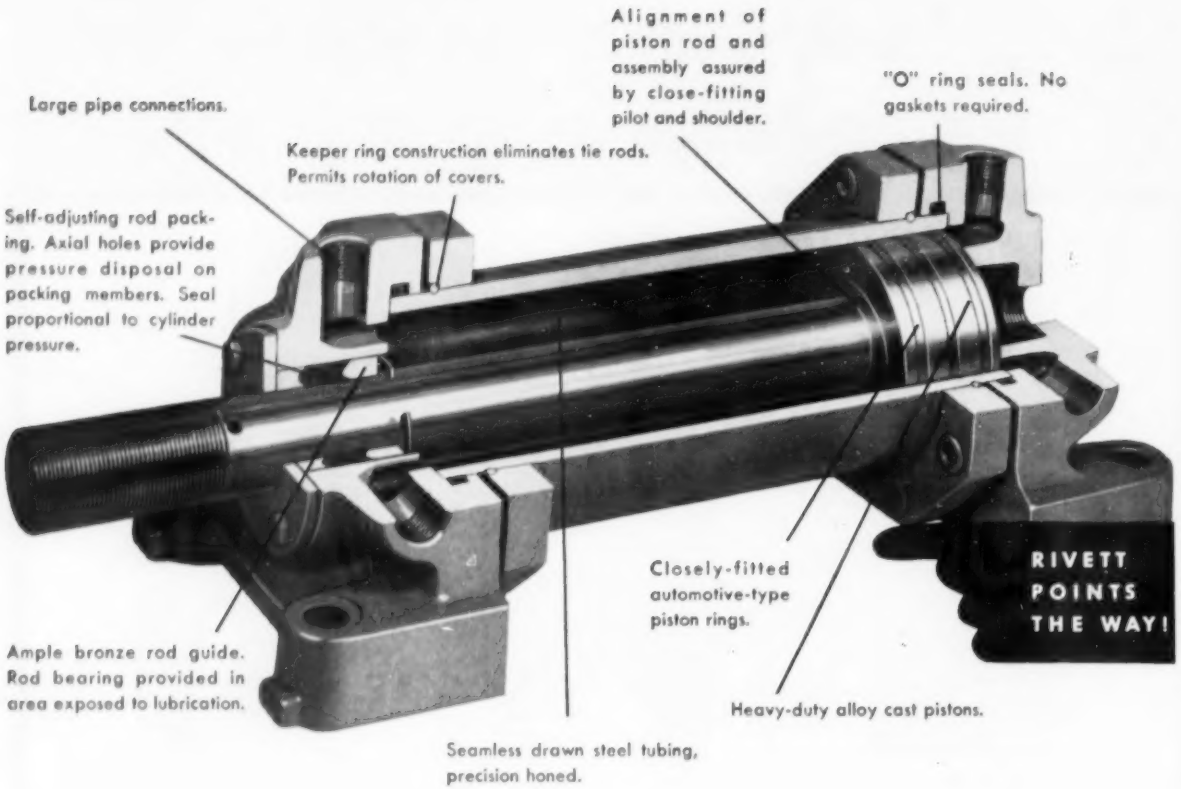
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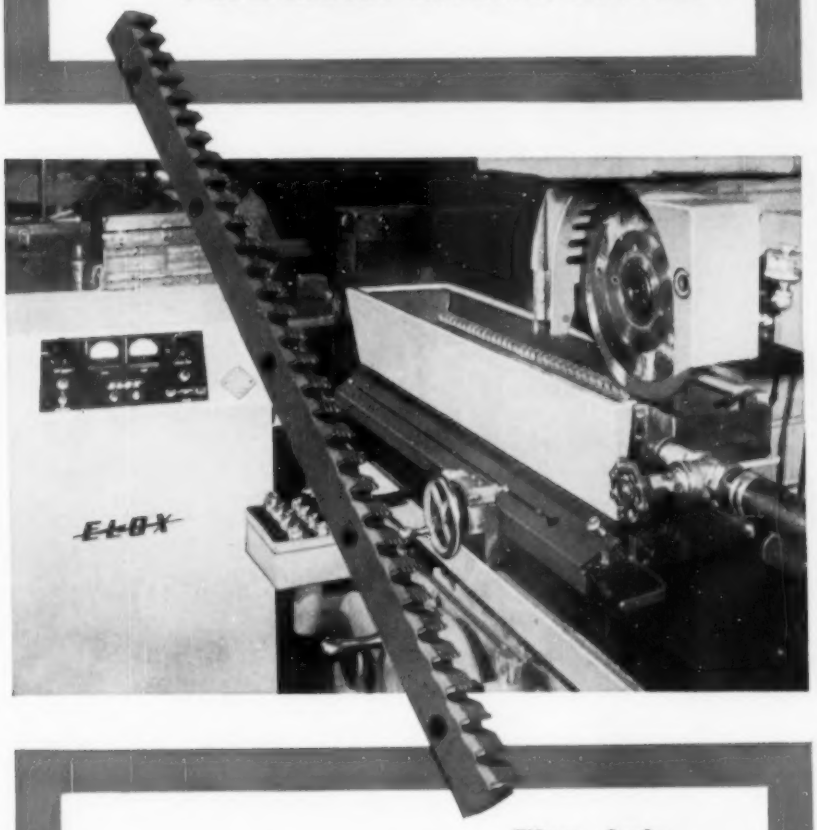

Savings on preformed carbide blanks	$ 32.00
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The Job...
Broach, used for broaching the pine tree form on turbine blades of the J-57 Jet engine.

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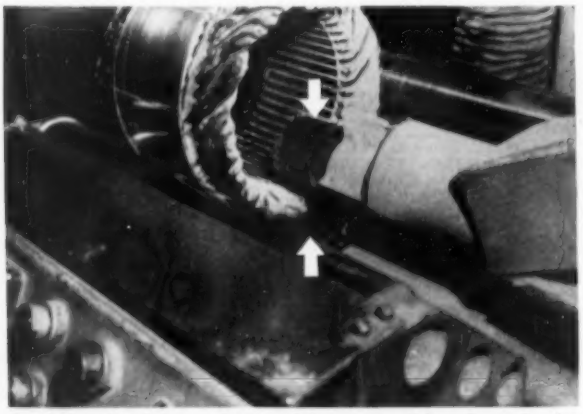

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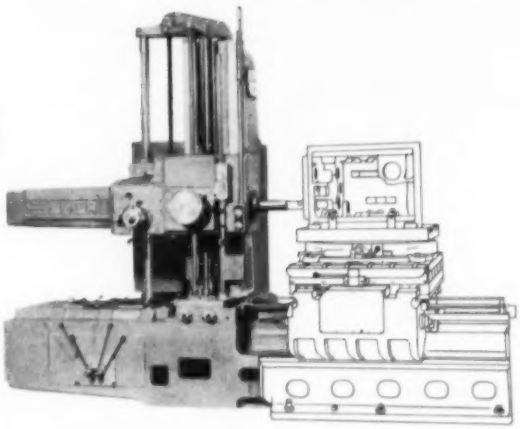

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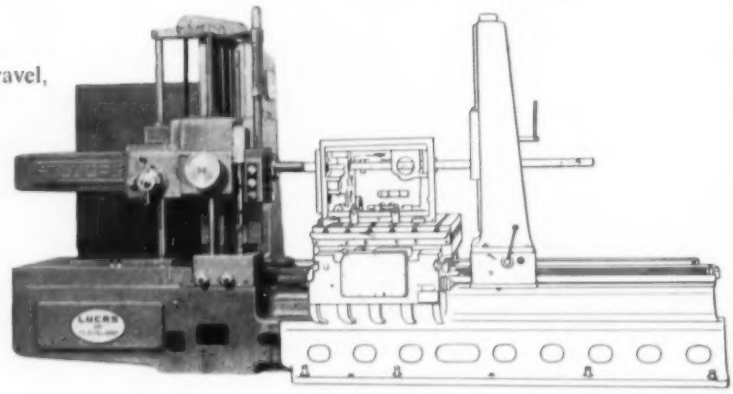

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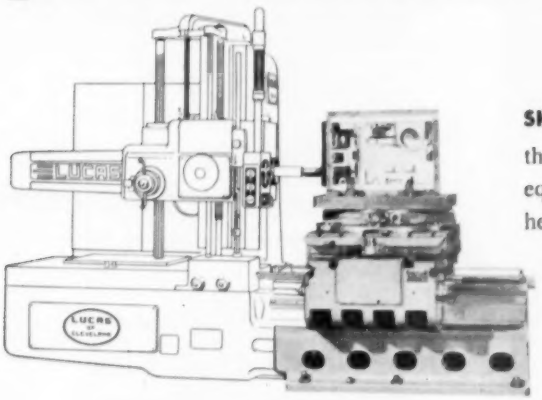
in engineering research
in maintenance applications
or several, in combination

your choice of beds



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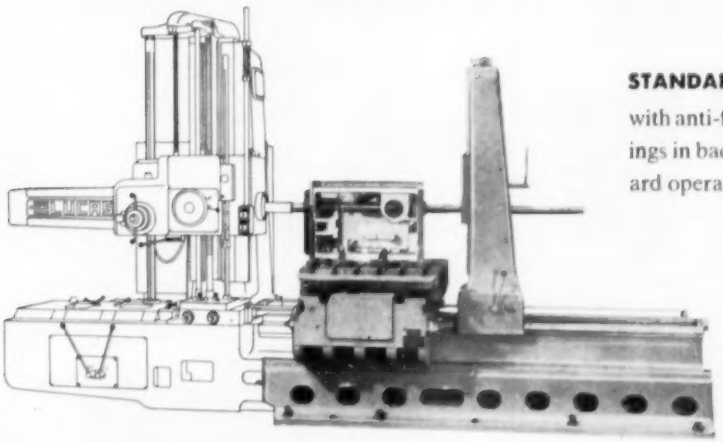
the most compact and economical equipment for precision stub boring, heavy milling and horizontal drilling.



STANDARD BED WITH BACKREST

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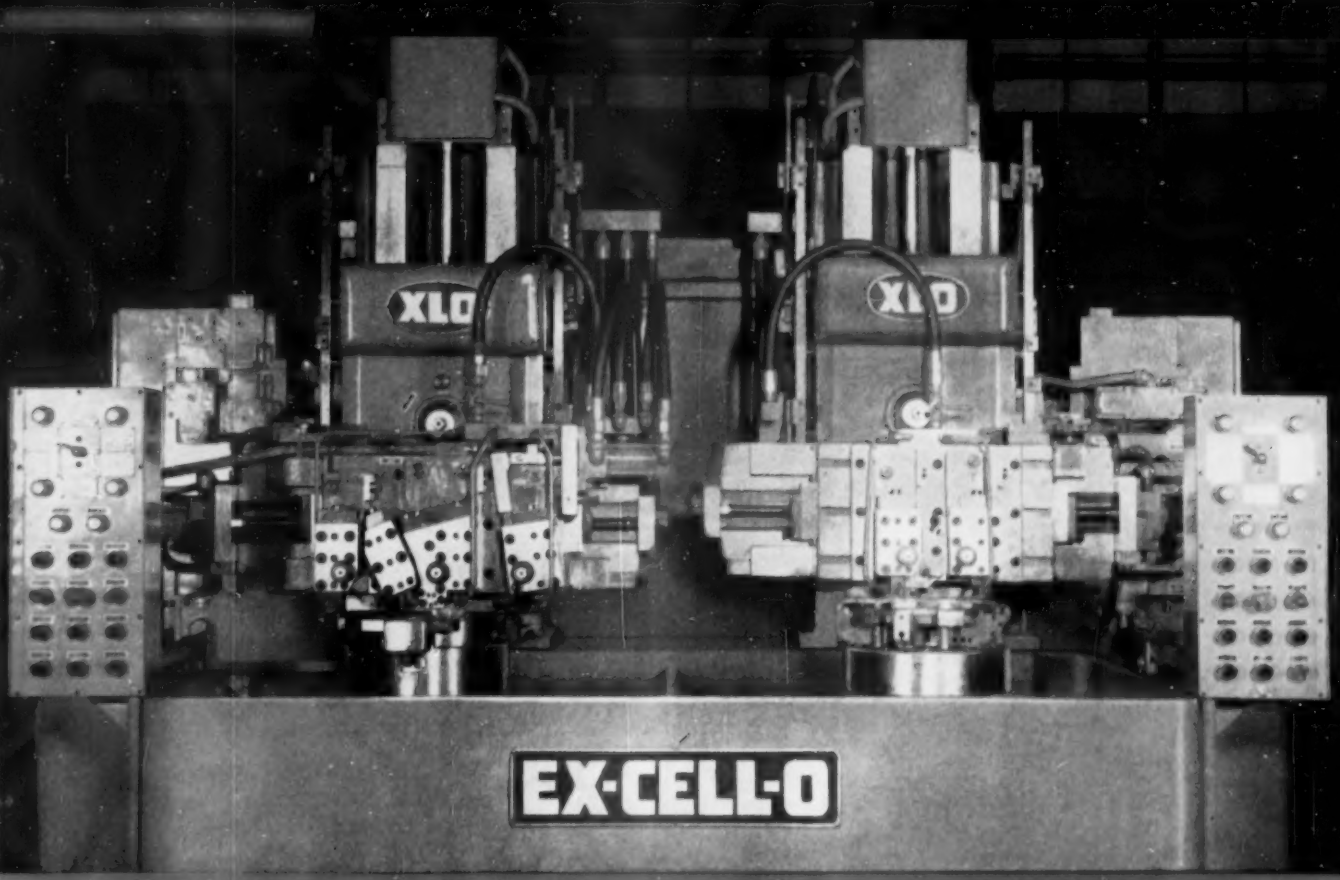
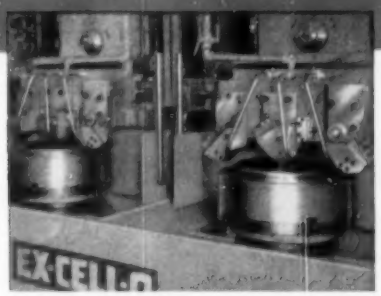
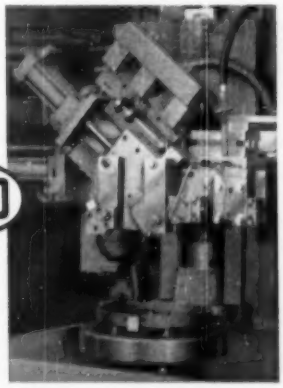


Twin spindles Double work capacity



This arrangement uses a magnetic chuck to hold an automotive part for processing.



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The Style 432 machine as fitted with an auxiliary slide for angular cuts.

A single operator on this Ex-Cell-O Vertical can precision turn, bore, face, groove and chamfer two identical or completely different work-pieces simultaneously. All operations may be performed singly or in combination, and don't overlook the loading ease and tool accessibility of this vertical boring machine.

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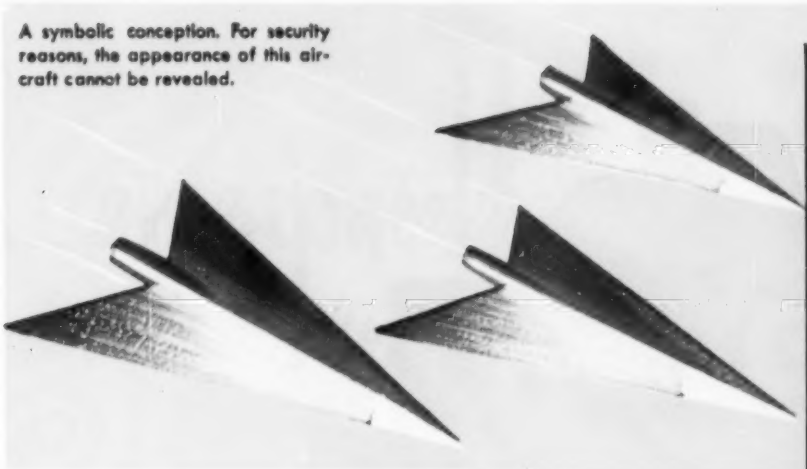
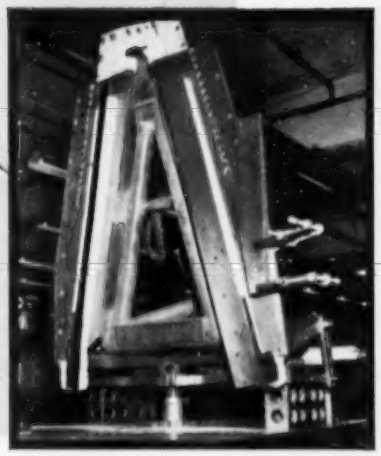


A symbolic conception. For security reasons, the appearance of this aircraft cannot be revealed.



A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.

In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

EPON® RESIN

dies, tools, jigs, molds and fixtures

Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

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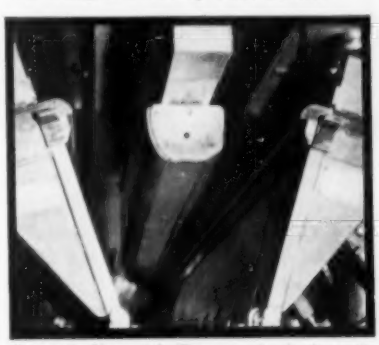
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for *production* as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.

Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.



Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

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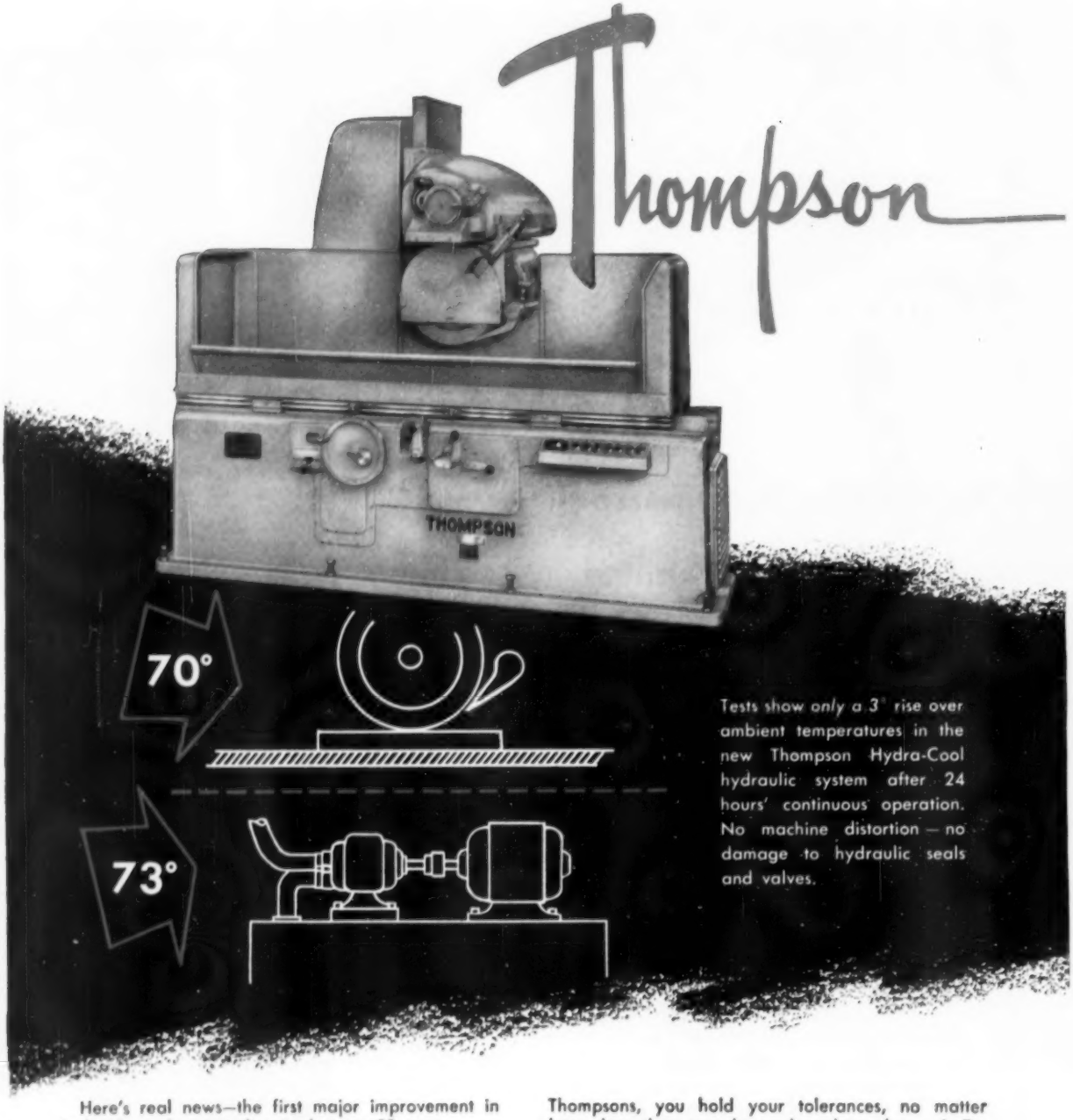
SHELL

Thompson



Tests show *only a 3°* rise over ambient temperatures in the new Thompson Hydra-Cool hydraulic system after 24 hours' continuous operation. No machine distortion — no damage to hydraulic seals and valves.

Here's real news—the first major improvement in hydraulic surface grinding in the past 20 years.

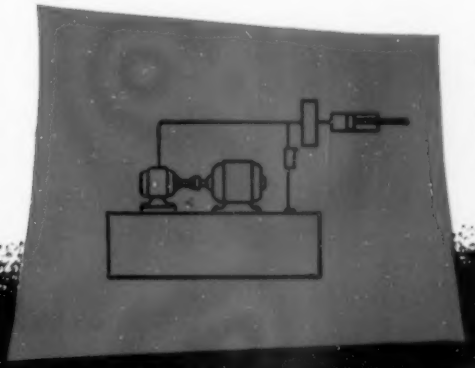
Heat, generated by continuous production grinding and constant hydraulic system operation, has long been a serious problem. General machine distortion, caused by extremes of temperature on top and bottom surfaces, has made close tolerances impossible to achieve. Excessive heat is destructive to the hydraulic system itself. Various and costly corrective measures have failed to solve this heat problem. Oil cooling and insulating devices have been only partially successful.

Now, the new Thompson Hydra-Cool system eliminates hydraulic heat *at its source*—with the new Thompsons, you hold your tolerances, no matter how close they may be or how long the run! Exhaustive tests have convincingly proved that, even after 24 hours of continuous operation, temperatures in the new Thompson Hydra-Cool hydraulic system have risen *only 3 degrees above ambient temperatures.*

To you, the new Thompson Hydra-Cool hydraulic system assures greater precision, less scrap loss, more trouble-free hydraulic operation—actual savings in dollars and cents! The new Hydra-Cool hydraulic system is available on all types of Thompson machines 40 inches and above in work length AT NO EXTRA CHARGE.

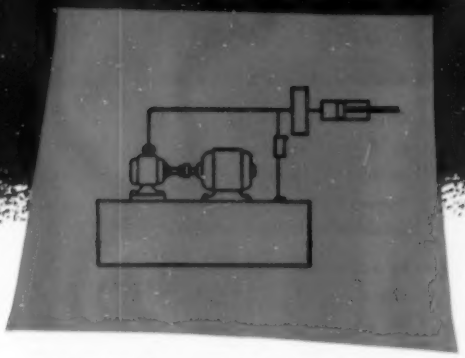
Again...THOMPSON LEADS IN SURFACE GRINDING ENGINEERING

— grinders eliminate hydraulic system heat

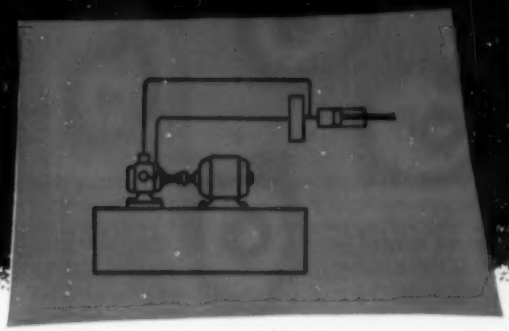


System No. 1—Constant volume hydraulic pump systems provide a continuous flow of oil for table reciprocation with pressures controlled by a relief valve set for greatest work need. Total pump volume circulates throughout the system continuously, generating heat even when the table is at rest. Oil coolers are a necessity on production work involving precision grinding.

WHICH TYPE OF SYSTEM WOULD YOU RECOMMEND?



System No. 2—Variable volume hydraulic systems regulate oil flow to the work requirement at adjustable rates, reducing oil flow through the system to only that volume necessary for each job. This limiting of flow through the system is an improvement over constant delivery systems but pressures within the system are still controlled by preset relief valve settings so that near constant pressures are maintained throughout the run. Oil coolers are also necessary for these systems.



The Thompson Hydra-Cool System*—New, pressure-compensating, variable delivery systems on new Thompson grinders control the rate of table movement and operating pressures automatically through a single hand lever control. As operator adjusts rate of table movement for the initial phase of each job, pressures within the system adjust automatically for the exact requirement to move the table smoothly and a constant speed. This modern pressure servo type system keeps HP input to the minimum. When the table is stopped, the pump ceases to pump oil. Hydraulic system heat remains at levels close to the ambient temperatures of the room. Distortion of the grinder bed is completely eliminated . . . at the source, without accessory cooling systems or expensive insulation methods. YOU GET THESE ADDED ADVANTAGES AT NO EXTRA COST.

*PATENT APPLIED FOR

MAIL THIS COUPON TODAY!

The Thompson Grinder Company ★ ★ Springfield, Ohio, U. S. A.

Please send me your free booklet giving important facts on the new Thompson Hydra-Cool Hydraulic System.

NAME _____ TITLE _____

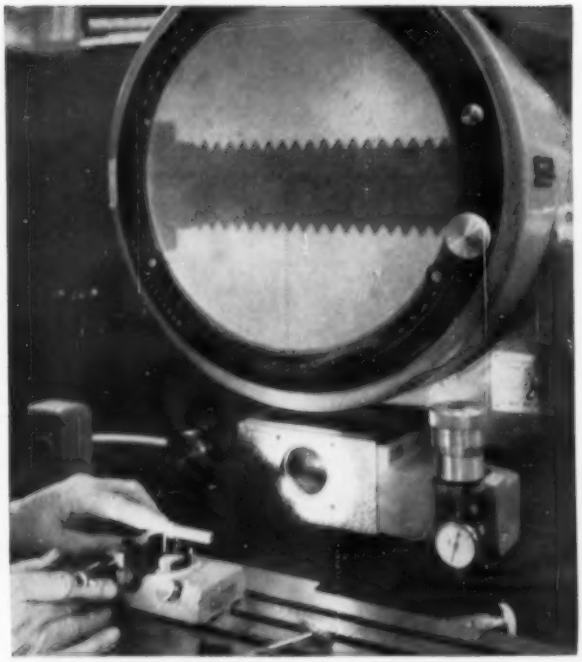
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Thompson

SURFACE GRINDERS



THIS COMPARATOR CHECK, part of Bristol Quality Control, assures accurate outside diameter, pitch diameter, thread form and lead. Precision inspections like this guard quality at every step in production of Bristol socket screws.

For that truly "finished" appearance specify

Bristol Socket Cap Screws

Bristol socket cap screws add the crowning touch to the craft of a master machinist.

Whether it's a jig, fixture, precision tool, or the final product itself, these cap screws give you more than just holding power.

Diamond knurled heads highlight the care we take in producing these screws, make for easy handling and a pleasing appearance.

Precision cut threads (in NF and NC, Class 3A fit) allow these screws to spin easily into place, fit perfectly, wrench up tightly.

The Bristol Multiple-Spline socket (available at no extra cost) or industry standard hex socket take the wrench easily. There's no skidding or marring of finished surfaces. And the Multiple-Spline socket lets you wrench screws tighter with no danger of stripping out the socket.

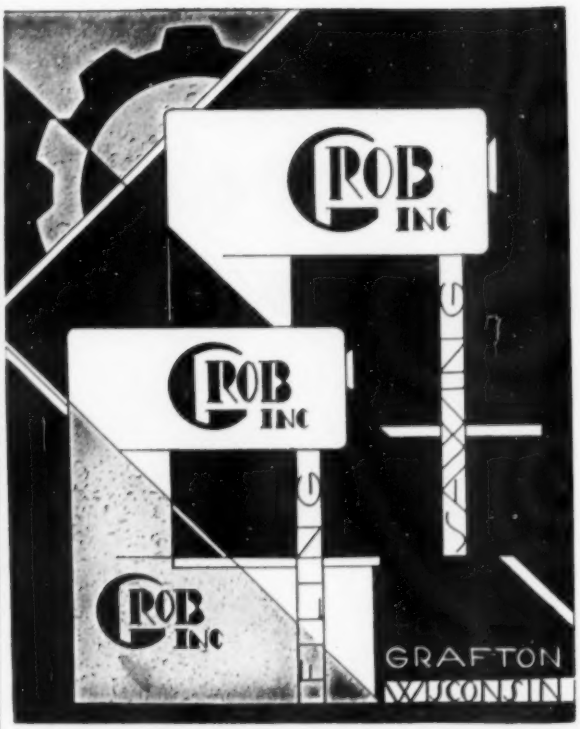
See your industrial distributor for all the facts on these quality cap screws for your quality products. Available in alloy steel and stainless. Flat-head cap screws, centerless-ground shoulder screws, pipe plugs, set screws also available in the most complete line on the market. A-6.33

Precision socket screw manufacturers since 1913

*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½"

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-8-230-1



USE READER SERVICE CARD; INDICATE A-8-230-2

Easy TO AVOID Oversize and Bell-Mouthed Holes!

When oversize and bell-mouthed holes are caused by the work being out of alignment with the spindle, the trouble can be remedied by using a Ziegler Floating Holder in place of an ordinary holder. It's as simple as that!

By automatically compensating for inaccuracies in alignment up to 1/32" radius, or 1/16" diameter, the Ziegler makes possible perfect work in spite of carelessness on the part of the operator.

Prove this to yourself by changing over to the Ziegler on your next tapping or reaming job. The elimination of spoilage losses will pay for it many times over.

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY

13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-8-230-3

High-Precision Gear Production

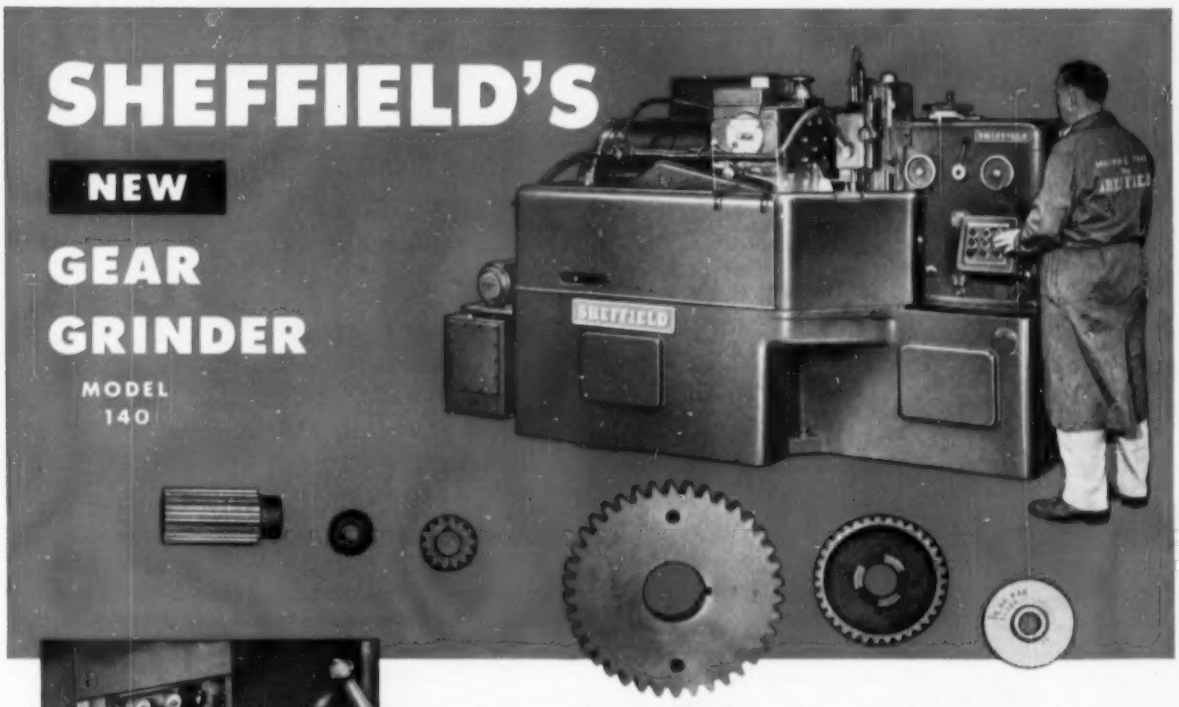
INCREASED 300% *on*

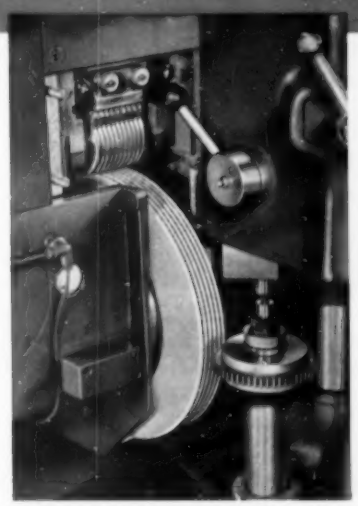
SHEFFIELD'S

NEW

GEAR GRINDER

MODEL 140





Relationship of crushing roll, grinding wheel and work part.

Precision gears for aircraft, fire control, servo mechanisms, guided missiles, transmissions and machine tools may be ground to a total composite error of less .0005" at production rates three times faster than heretofore possible.

The secret is a fast-cutting grinding wheel accurately crushtrued to the basic rack form, operated like a hob and with the work rotating as the teeth are ground—either from the solid hardened blank or a preformed gear.

FIELD REPORTS—An aircraft engine manufacturer says "Gears ground on the Model 140 Grinder have passed our surface tempering inspection and show no grinding burns".

A large precision instrument manufacturer, in speaking of the Model 140, writes, "We have inspected gears ground on prominent gear grinders of both American and European manufacture. Our findings have revealed that this machine is by far the most accurate to date."

MACHINE CAPACITY (Work Gear)

Outside Diameter	Up to 8"	Pitch	8 to 100
Face Width	Up to 5"	Helix Angle	Up to 45°
Distance between centers	15"		

For complete information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 19

New Phone — Lincoln 5577

7656

the **SHEFFIELD** *corporation*

manufacture and measurement for mankind

It's an established principle for methods engineers in the "know"... while one or a group of parts is feeding past the cutters, a second fixture mounted on the machine is reloaded for its turn at the feeding station. In many cases handling time chargeable to cost is practically nil. ¶Advantages of this principle are very much worth while for the milling operation illustrated here. A CINCINNATI® 28" Vertical Hydro-Tel, with 96" table traverse, is equipped with duplicate fixtures and a four-spindle head to automatically profile mill four connecting rods at one time. Surfaces milled are indicated in the drawing. This Hydro-Tel is equipped for 360° automatic profile milling, one of the seven ways in which Hydro-Tel machines are built for various types of work. The complete list includes:

1) **Conventional milling, low series spindle speeds**
2) **Conventional milling, high series spindle speeds**
3) **Die sinking**
4) **360 degree automatic profiling, non-selective**
5) **Die sinking and 360 degree automatic profiling, non-selective**
6) **360 degree automatic profiling, selective**
7) **Die sinking and 360 degree automatic profiling, selective**

Drawing of part. Surface outlined is automatically profile milled in one continuous cut.

28" Vertical Hydro-Tels have plenty of range for large work; 60", 96" or 120" table traverse; single spindle head or 2, 3 or 4 spindles. May we give you more information? Write for catalog M-1773-2. For brief specifications look in Sweet's Machine Tool File.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

TOOL NEWS

carbide

Sharpening the blades of 88 blade RIGIDCUT 15 in. diameter cutter. Note the remarkably clean design

WESSON Milling Cutters Show How to Get Top Production, Life

Sometimes the tool itself has to show you what CAN be done.

For instance, take the problem of milling the cylinder block ends for an important CAR ABOUT TO BE ANNOUNCED. To get top results on this job, calculations showed the face milling cutter should be 15 in. diameter and have some 88 blades. Of course standard blades were preferred to keep cost down.

Where to find such a cutter?

After studying all makes, the engine builder found that there was just one type of cutter that could do all this and also had the necessary rigidity and strength.

That cutter had already proved itself in a year and a half of service *in Cleveland, Detroit and Lima.*

It was the **WESSON** Standard High Speed Fine Finish Cutter—one of **WESSON'S** famous RIGIDCUT Series.

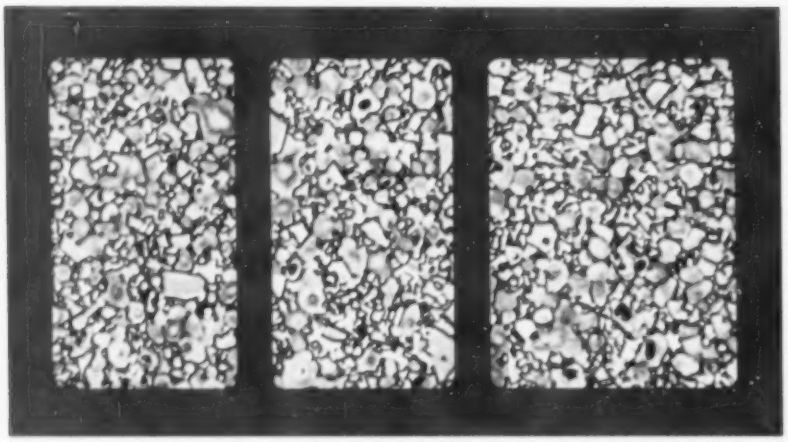
Reason: With the **WESSON** design you can use standard carbide tipped dovetail blades. *No space is needed in the gullet for the lock.* The blades lock from the bottom. You get smooth chip flow, with no obstructions, remarkable rigidity, solid blade backing.

Its no wonder that **WESSON** Rigidcut mills are setting new production records for output and tool life in all kinds of operations, everywhere.

If you are not familiar with Rigidcut milling cutters, our merchandising department will send you complete information. Just write on your company letterhead. You'll be glad you did.

TOOL NEWS carbide

"Inside Story" of Grades Told in Selector Bulletin



1500X Photomicrographs of the same Wessonmetal grade. Note close similarity.

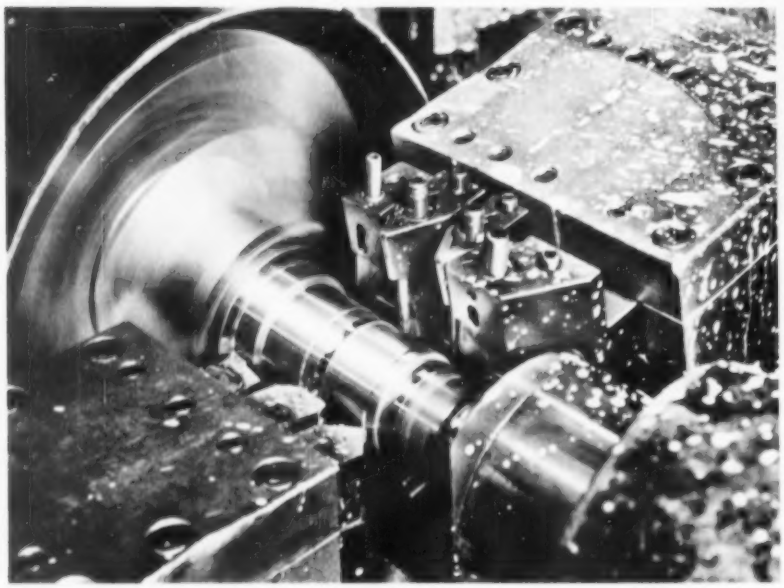
You can find a quick answer to what grade of carbide to use (and why) in a new technical bulletin just released by **WESSON**.

The bulletin tells how various ingredients added to tungsten carbides affect performance and tool life. You can use it as a standard method for selecting and applying carbides on the basis of operational needs in your own plant.

It is the soundest method of carbide grade selection *when carbides are as consistent* in chemical analysis and physical characteristics as are the various Wessonmetal grades.

Ask for Bulletin No. 57-1 WM.

Multi-Cuts Cut Waste Time 90%

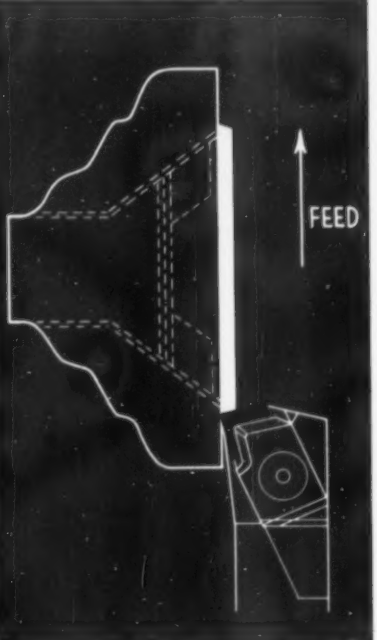


"A production of over 1400 parts per grind compared with about 200 pieces per grind previously" is one report on **WESSON** Multi-cut band type tools with indexable inserts. They are indexed only once every shift. In addition, the report says, the grooving tools shown here helped to cut total machine service time by 90%. Tool pre-setting time is completely eliminated. Downtime for tool changes is cut in half. And grinding time is cut 80%.

tools **Wesson** carbide **Wessonmetal**

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

Throw-Aways Throw Costs for Loss



Here are a few typical figures that tell their own story probably better than we can. The job is the facing of a shell-molded diffuser. The column at the left is for a conventional flat tool. The one at the right is for a **WESSON** THROW-AWAY:

	WAS	IS
Tool change time (secs.)	300	30
Pcs. per tool change (index)	130	280
No. of grinds or edges	10	8
Cost per grind	$0.25	None
Tool grind cost	2.50	—
Initial tool or insert cost	3.15	1.58
TOOL COST PER PIECE	.024	.0071

Want some specs on **WESSON** throw-away tooling? Ask for Bulletin No. 55 10 M.

LITHO IN U.S.A.

TOOL NEWS
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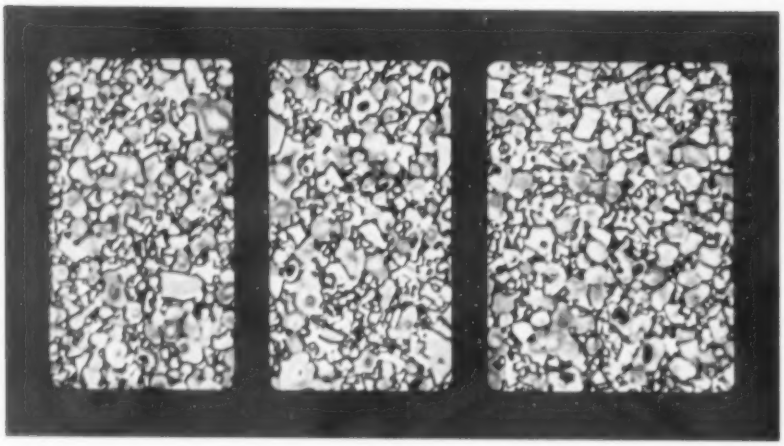

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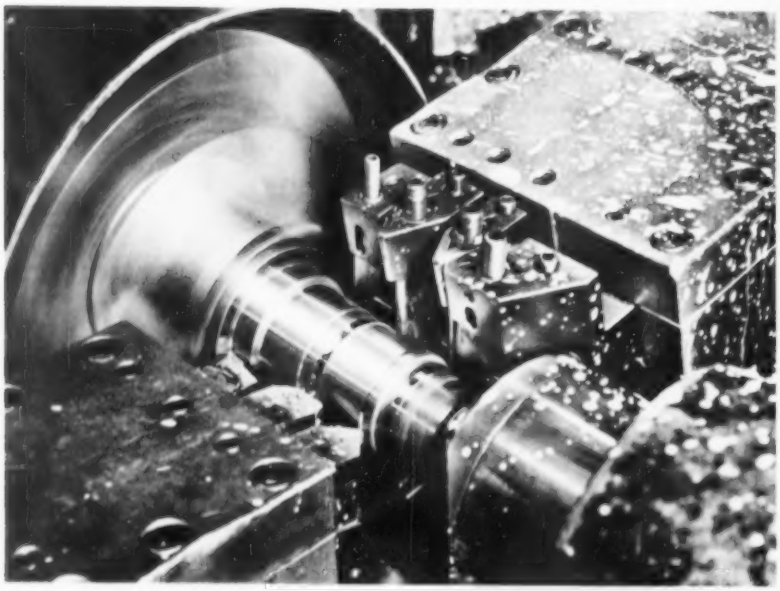

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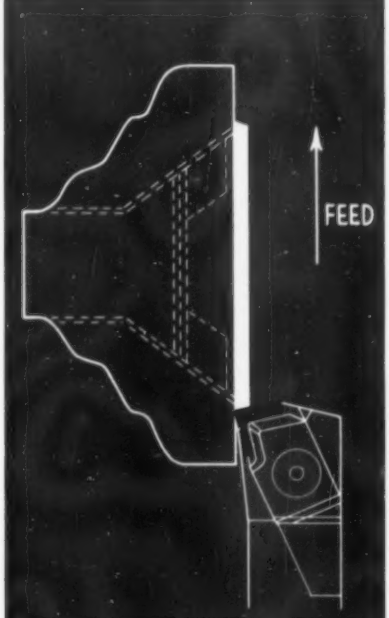

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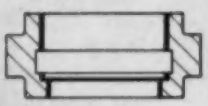
LITHO IN U.S.A.

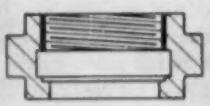
Bodine

case history no. 45

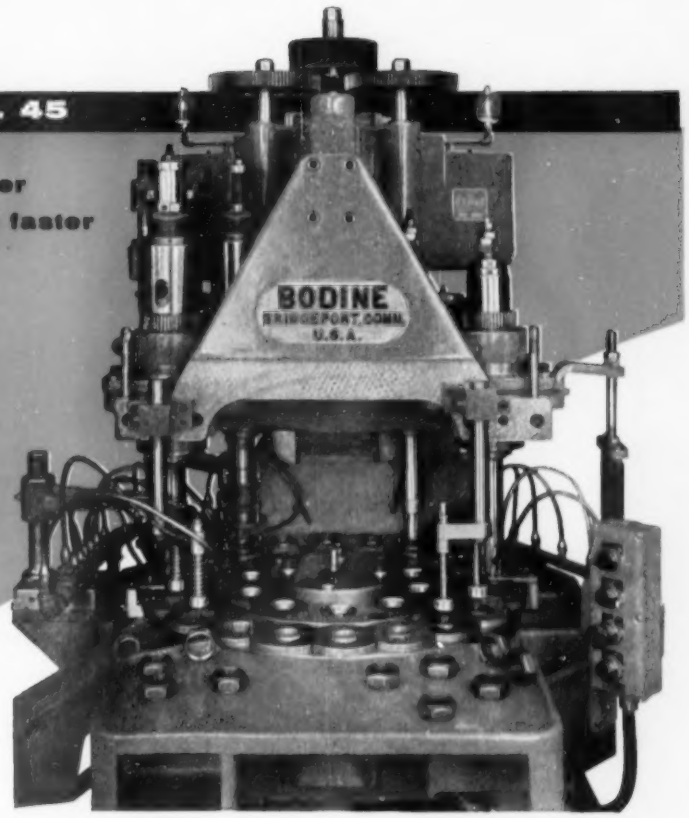
how DART makes better UNION NUTS . . . much faster



REAM and SEAT with combination tool



TAP . . . with collapsible tap (1.440-13 Thd; 1.703-12 Thd; 2.068-11 Thd.)



simplified, easily changed tooling handles sizes up to 2.068"-11 thread two at a stroke . . . 20-30 per minute

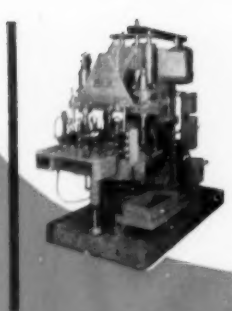
Not only does this Bodine 48-30 machine handle many size variations up to this husky maximum, it also makes much BETTER nuts because "floating" work holders have licked the problem of eccentricity in the castings.

Reaming is done with a carbide inserted-blade combination tool, the threading with a collapsible tap.

Changeover from one size of nut to another is quickly accomplished by changing cutting tools and inserts in the indexing dial. Bodine's standard 2" heavy duty flange mounted spindles are used.

Here's yet another instance where a Bodine Basic Machine and Bodine methods do a tough job much faster and much better at lower cost. Perhaps we can show you a way to do likewise. Write Dept. TE-8.

Production Data: Cast malleable iron nut sizes up to 2.068"-11 thread, machined 2 at a stroke . . . 1000 to 1500 pieces per 50 min/hr.



Is space a factor in your shop? This complete, compact Bodine production unit occupies only 5' x 8' of floor space.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

4R087

UNBRAKO STRIPPER BOLTS NOW AVAILABLE WITH THE NYLOK* SELF-LOCKING DEVICE

UNBRAKO STRIPPER BOLTS with the Nylok self-locking device. Nylon pellet locks them with positive, dependable prevailing torque action. Bolts are reusable.

SELF-LOCKING UNBRAKO STRIPPER BOLTS fasten this stripper plate securely. Constant vibration, shock, extended running time will not cause these bolts to loosen.

Self-locking UNBRAKO stripper bolts (shoulder screws) save time, money and headaches wherever they are used. They eliminate the costly, time-consuming checking of bolts to see that they are securely tightened. They protect precision tools and dies from damage caused by vibration-loosened bolts. They assure that your equipment will have longer service life, with reduced maintenance and downtime.

UNBRAKO stripper bolts are manufactured to the highest standards of precision. They are made of heat-treated alloy steel with continuous grain flow lines and have fully formed Class 3A threads finished close to the shoulder for maximum strength and holding power. Shoulders, held to fine tolerances, are concentric with heads and threads for uniformly accurate fit. The tough, resilient, *permanent* nylon locking pellet is integral with the threaded section.

All standard UNBRAKO socket screw products are available with or without the Nylok self-locking device. Authorized industrial distributors stock them. Write us for catalog and technical data on the complete line. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

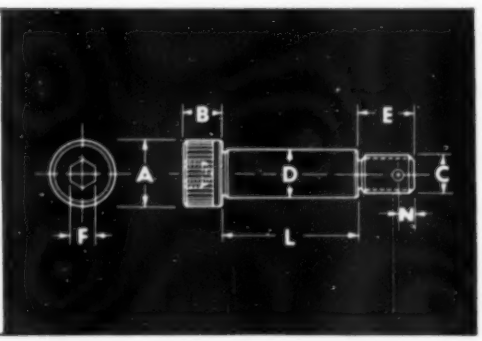
SPS

JENKINTOWN PENNSYLVANIA

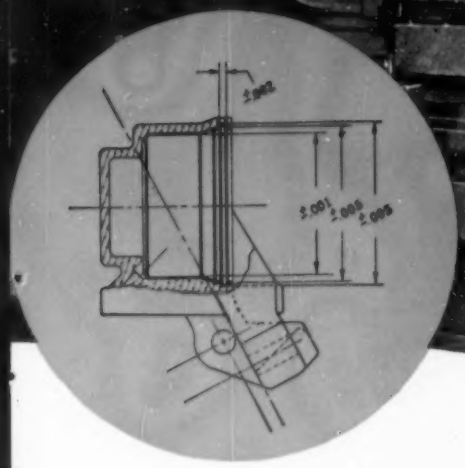
We also manufacture precision titanium fasteners. Write for free booklet.

SPECIFICATION DRAWING. UNBRAKO stripper bolts are available with standard shoulder lengths ranging from ⅜ to 6 in.

D	Shoulder Diameter*	¼	5/16	⅜	½	⅝	¾
C	Thread Diameter UNC	10—24	¼—20	5/16—18	⅜—16	½—13	⅝—11
E	Thread Length	⅜	7/16	½	⅝	¾	⅞
A	Head Diameter	⅜	7/16	9/16	⅝	⅞	1
B	Head Height	3/16	7/32	¼	5/16	⅜	½
F	Size of Hex. Hole	⅛	5/32	3/16	¼	5/16	⅜
N	Pellet Location	.141	.172	.187	.203	.234	.281
	*Shoulder Diameter Tolerances Max.	.249	.3115	.374	.499	.624	.749
	*Shoulder Diameter Tolerances Min.	.248	.3105	.373	.498	.623	.748



New OLOFSSON Special

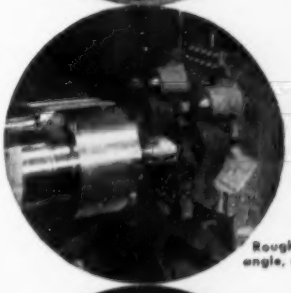


Boosts Production of Rear Band Servos

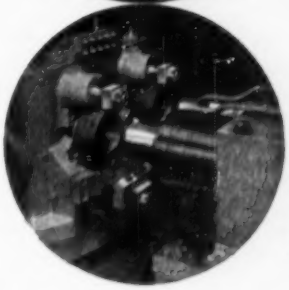
This new OLOFSSON Special, Three Station, Two Way Precision Boring Machine performs multiple operations on rear band servos in the plant of a leading automobile manufacturer.

In the three stations shown at right, the machine rough bores, forms angle, grooves, and finish bores. Production is 220 pieces per hour.

STATION 1
Load and unload two parts.



STATION 2
Rough bore, form angle, and groove.



STATION 3
Finish bore.

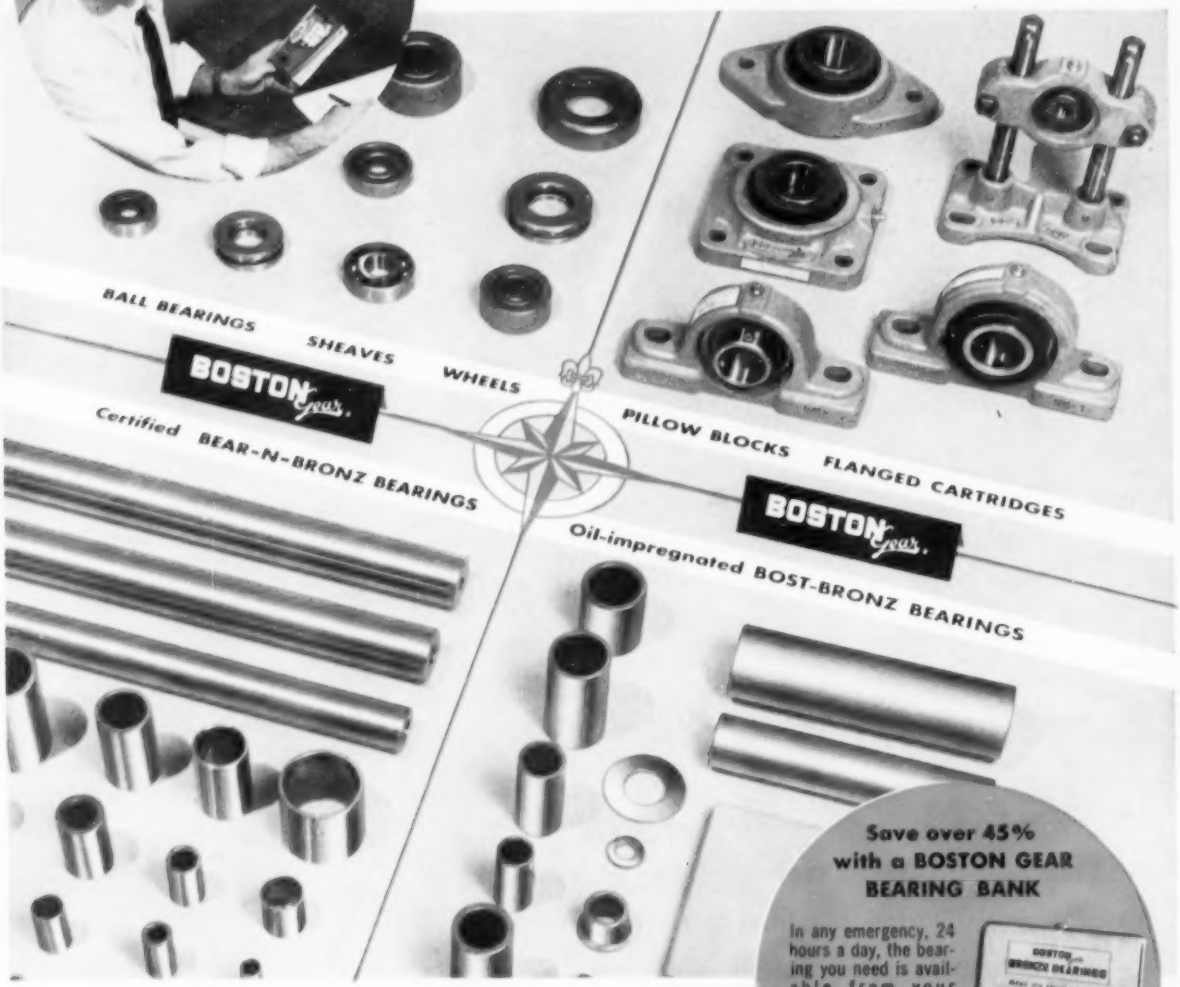
For "*Profit-Making*" Special Machinery designed to lower your production costs, consult OLOFSSON. You'll find it pays! Phone IV onhoe 4-5381, or write . . .

THE OLOFSSON CORPORATION
2731 Lyons Avenue Lansing, Michigan

Manufacturers of PRECISION BORING MACHINERY AND SPECIAL MACHINERY

Get your BEARINGS from this big line . . .

and keep headed for lower costs



You'll find the bearing products you need among the thousands of types and sizes listed in the BOSTON GEAR Catalog No. 56. There is no finer quality, and you can get them faster . . . FROM STOCK — at your nearby BOSTON GEAR Distributor. Call him today, for prompt service. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

7124 POWER TRANSMISSION PRODUCTS FROM STOCK

CALL YOUR **BOSTON gear** DISTRIBUTOR

Stock Gears • Sprockets and Chain • Speed Reducers • Bearings • Couplings

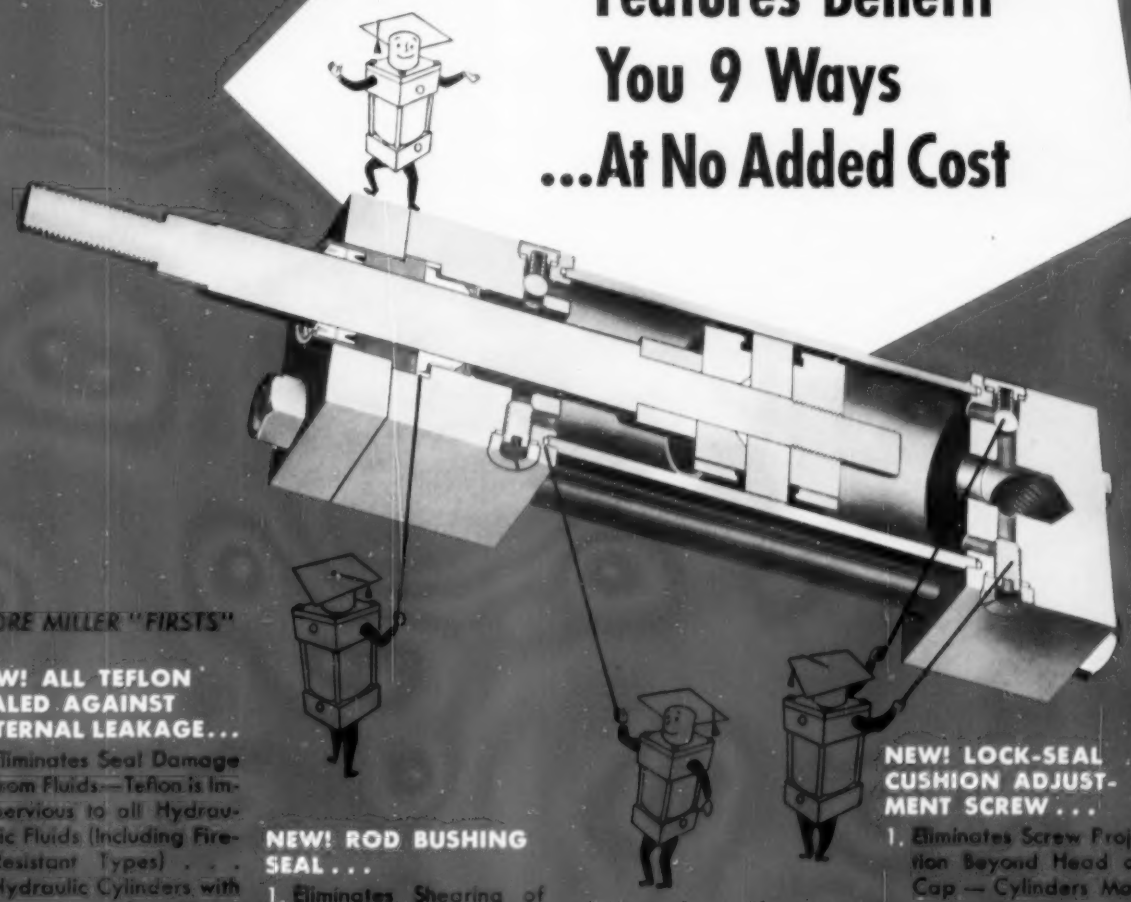
Save over 45% with a BOSTON GEAR BEARING BANK

In any emergency, 24 hours a day, the bearing you need is available from your "BANK". No costly delays. Bearings cost 46% less than if bought separately.

"BANK" assortments available in BEAR-N-BRONZ or BOST-BRONZ, from your Distributor.

Miller®

4 New Hydraulic Cylinder Features Benefit You 9 Ways ...At No Added Cost



MORE MILLER "FIRSTS"

NEW! ALL TEFLON SEALED AGAINST EXTERNAL LEAKAGE...

1. Eliminates Seal Damage from Fluids—Teflon is impervious to all Hydraulic Fluids (Including Fire-Resistant Types) . . . Hydraulic Cylinders with Teflon Piston Cups Slightly Higher.
2. Eliminates Seal Damage from High Temperatures —Teflon Sealed Cylinders Operate At —100° F. to 500° F.

NEW! ROD BUSHING SEAL . . .

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at Extreme Pressures.

NEW! SHEF SEAL AT TUBING ENDS . . .

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at ANY Pressure—Teflon Sealing Ring is Backed Up by Zero Clearance Metal Shoulder.

NEW! LOCK-SEAL CUSHION ADJUSTMENT SCREW . . .

1. Eliminates Screw Projection Beyond Head and Cap — Cylinders Mount on Any Side.
2. Eliminates Manual Sealing and Locking After Flow Adjustment—Teflon Seal is Self Regulating and Self Locking.
3. Eliminates Accessibility Problems—Cushion Screw Interchangeable with Ball Check Position—Adjustable Through Small Wrench Hole Drilled in Interfering Machinery.

®du Pont Trademark for its tetrafluoroethylene resin

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Turn Page For Cross Section Of SHEF SEAL

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES

- Case-Hardened Chrome Plated Piston Rod
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers
- Interchangeable Square Design

Miller - FLUID POWER DIVISION
FLICK-REEDY CORPORATION
2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

Miller

Announces a New Space and Price Saving Hydraulic Cylinder Line

MORE MILLER "FIRSTS"

SAVE UP TO 76% OF COST

Heavy Duty Model LH—Same Size As Ordinary Gasket Type Square Design Low Pressure Cylinders			
BORE	NORMAL RATINGS	NON-SHOCK INTERMITTENT RATINGS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

Miller

Announces 50% More Power Per Cylinder Dollar

with Extra Heavy Duty

3000-5000 PSI MODEL H

HYDRAULIC CYLINDERS

Same Price and Mounting Dimensions as Miller 2000-3000 PSI Hydraulic Cylinders.

BOTH LINES MADE POSSIBLE BY SHEF SEAL

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Miller - FLUID POWER DIVISION
PICK-READY CORPORATION

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

OTHER MILLER QUALITY FEATURES

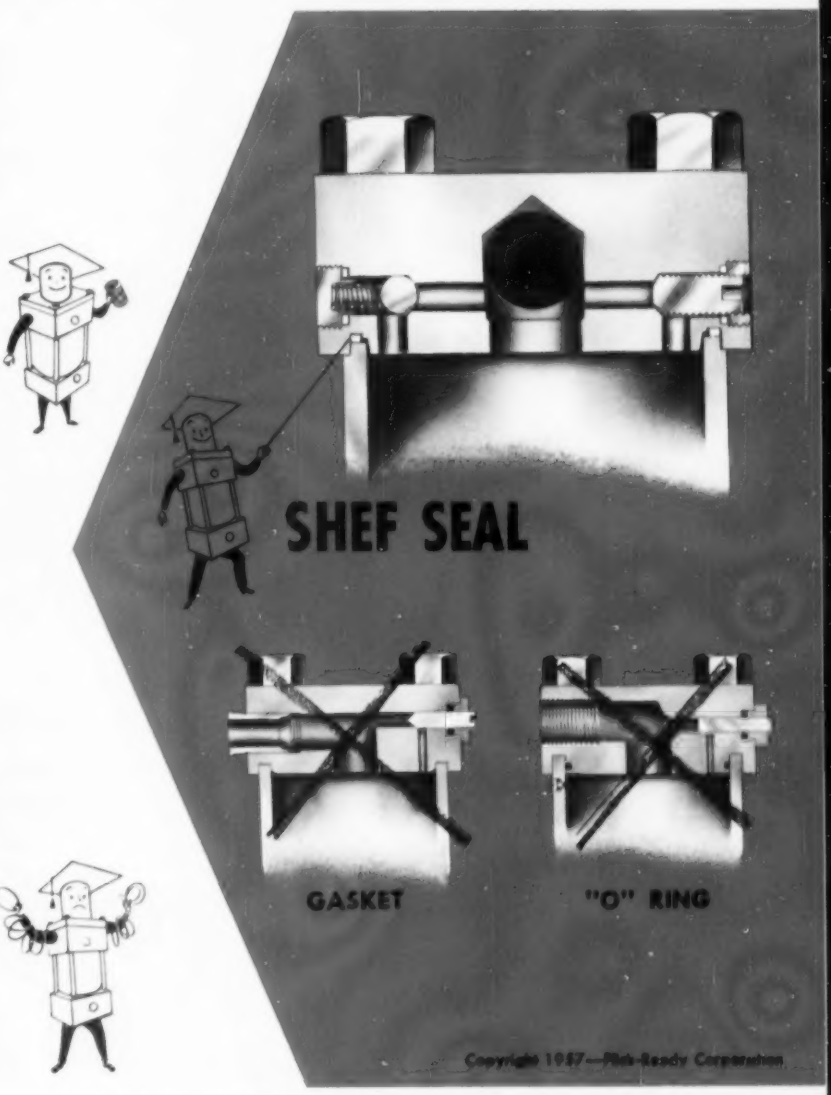
- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

SHEF SEAL Obsoletes All Other Hydraulic Cylinder End Seals . . . *at no added cost*

HAS EVERY ADVANTAGE

1. Pressure Energized—Sealing Effectiveness Increased with Pressure.
2. Zero Metal-To-Metal Clearance at all Pressures Gives You Perfect Seal Backup. Sealing Ring Cannot Extrude.
3. Simplified Servicing. No "Blind" Assembly. Sealing Ring Cannot Shear.
4. Teflon* Sealing Ring Withstands All Hydraulic Fluids at Temperatures from —100° F. to 500° F.
5. Head and Cap Axial Movement Does Not Destroy Sealing.
6. Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
7. One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
8. Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.



NONE OF THESE DISADVANTAGES

GASKET CONSTRUCTION

1. Unpredictable Results—Leaks and Blows Even at Low Pressures.
2. Outlawed by J.I.C. Eight Years Ago.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.

"O" RING CONSTRUCTION

1. High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
2. Blind Assembly Can Shear Sealing Ring—Difficult Servicing.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
4. Requires Large Inventory of "O" Rings
   —For Servicing Variety of Cylinder Bores.
   —For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.

*du Pont trademark for its tetrafluoroethylene resin.

SHEF SEAL—*Another Miller "First"*

When you buy Miller ... You buy extra years of worry-free Cylinder performance ...at competitive prices

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

Miller FLUID POWER DIVISION
FLICK-REEDY CORPORATION

Turn Page For More About MILLER

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

All Teflon Sealed —Perfect Sealing for Hydraulic Cylinders

HAS EVERY ADVANTAGE...

Teflon—As Static and Dynamic Seals

1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
2. Seals Perfectly in Cylinders at Temperatures from —100° F. to 500° F.
3. Can Be Molded Into Shapes That Have Zero Leakage—Hold Pressure Indefinitely.
4. With Proper Design of External Seal Cavities, Teflon Can Be Included *Without* Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

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Printed in U.S.A.

•du Pont trademark for its tetrafluoroethylene resin.

When you buy Miller
You buy extra years
of worry-free
Cylinder performance
...at competitive prices

NONE OF THESE DISADVANTAGES

Synthetic Rubber— As Static and Dynamic Seals

1. Unsatisfactory Except When Used With A Limited Range of Hydraulic Fluids.
2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
4. Normal Temperature Range Limited to 0° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Greatly Reduced Life at 150° F. to 250° F.
5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

Resin Impregnated Leather— As Dynamic Seals Only

1. Is Compatible with Many—But Not All—Hydraulic Fluids and Additives Including a few Fire-Resistant Types.
2. Normal Temperature Range Limited to —60° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Substantially Reduced Life at 150° F. to 250° F.
3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.

Miller Uses Leather Piston Cup Seals for Internal Sealing... Standard Price (Teflon Cups Extra).

Piston Rings— As Dynamic Internal Seals

1. Most Piston Rings Allow Some Leakage.
2. Allow "Slip" or "Drift" of Piston Due To Leakage—Unsatisfactory for Many Applications.
3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup—Unsatisfactory for Most Multiple and Automated Operations.
4. Allow Some Pressure Loss.
5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring —Especially During Startup.

All Teflon Sealed—*Another Miller "First"*

Miller FLUID POWER DIVISION
FLUID-READY CORPORATION
2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

SOLID CARBIDE
ELECTRO-GROUND
SOLID CARBIDE
ELECTRO-GROUND
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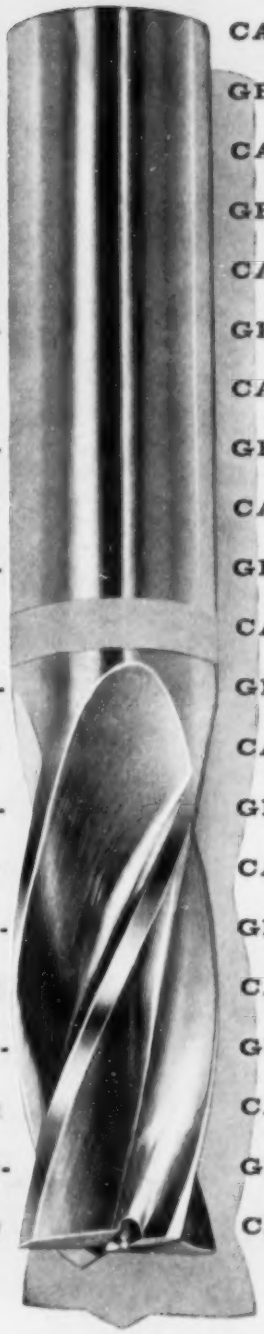


more

hours

of

useful

life

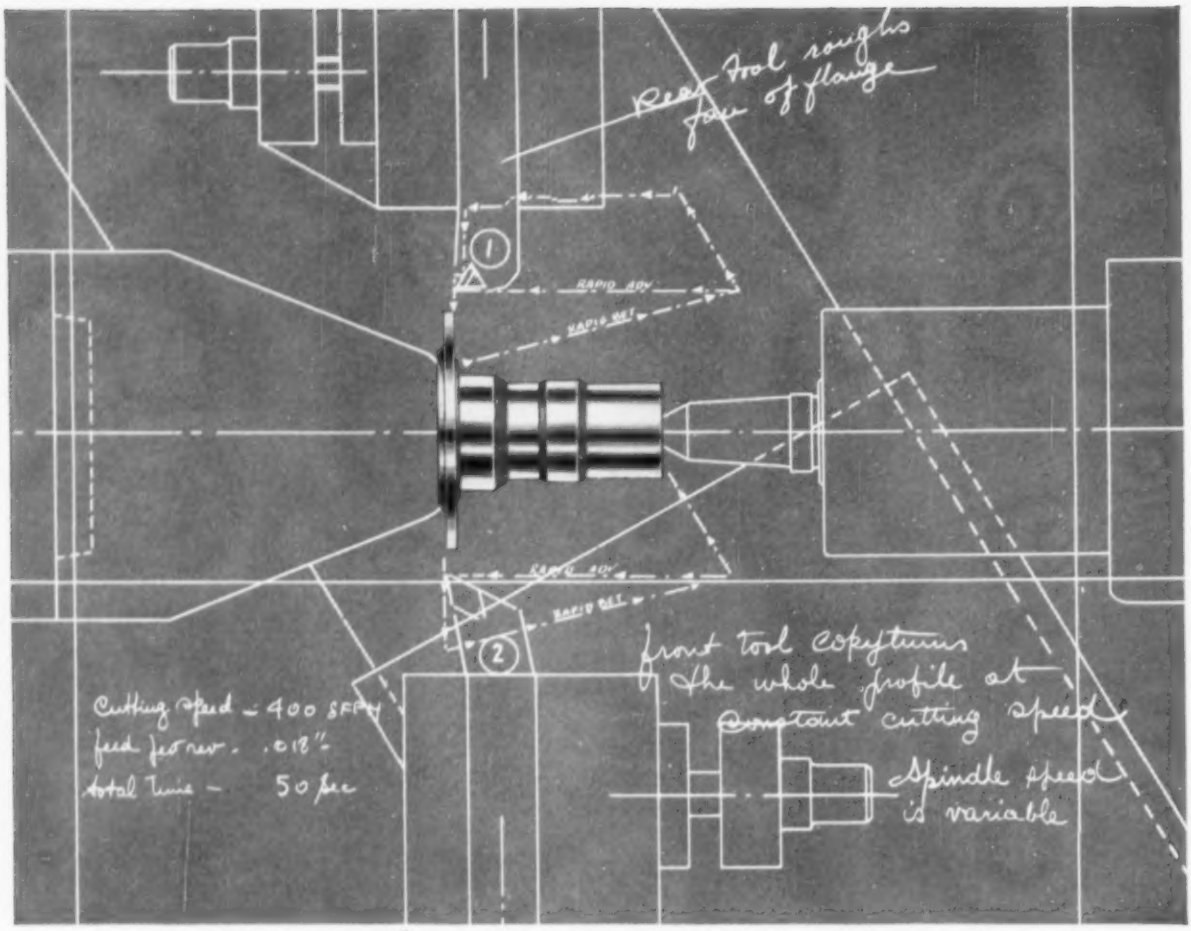
Elgin GOLDEN CIRCLE Carbide End Mills have sharp, smooth, hard cutting edges that LAST—and make your toughest jobs look easy! How come? First, they're solid carbide, of course. But most important, they are finished by Elgin's new Electro-Grind Process.

Electro-Grinding eliminates checked, chipped or flaked cutting edges caused by the strains and high temperatures of other production methods. With the extra fine grit wheels used by Elgin, Electro-Grinding assures the sharpest, smoothest cutting edges yet.

Use Elgin Golden Circle Carbide End Mills for more production hours between regrindings, for greater accuracy and lower tool costs. Write today for the complete new catalog. It shows Elgin's complete line of solid carbide end mills, drills, reamers and burs—all in stock for immediate delivery.

Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

ELGIN "Electro-Grinding" Makes the Most of Solid Carbide

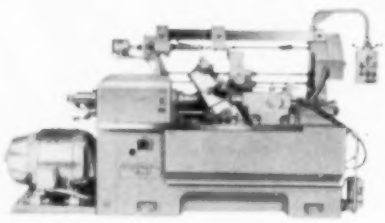

Rear tool roughs face of flange
RAPID ADV
RAPID RET
Front tool copyturns the whole profile at constant cutting speed
Spindle speed is variable
Cutting Speed – 400 SFPM
feed per rev. – .018"
total Time – 50 sec

In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

Conomatic

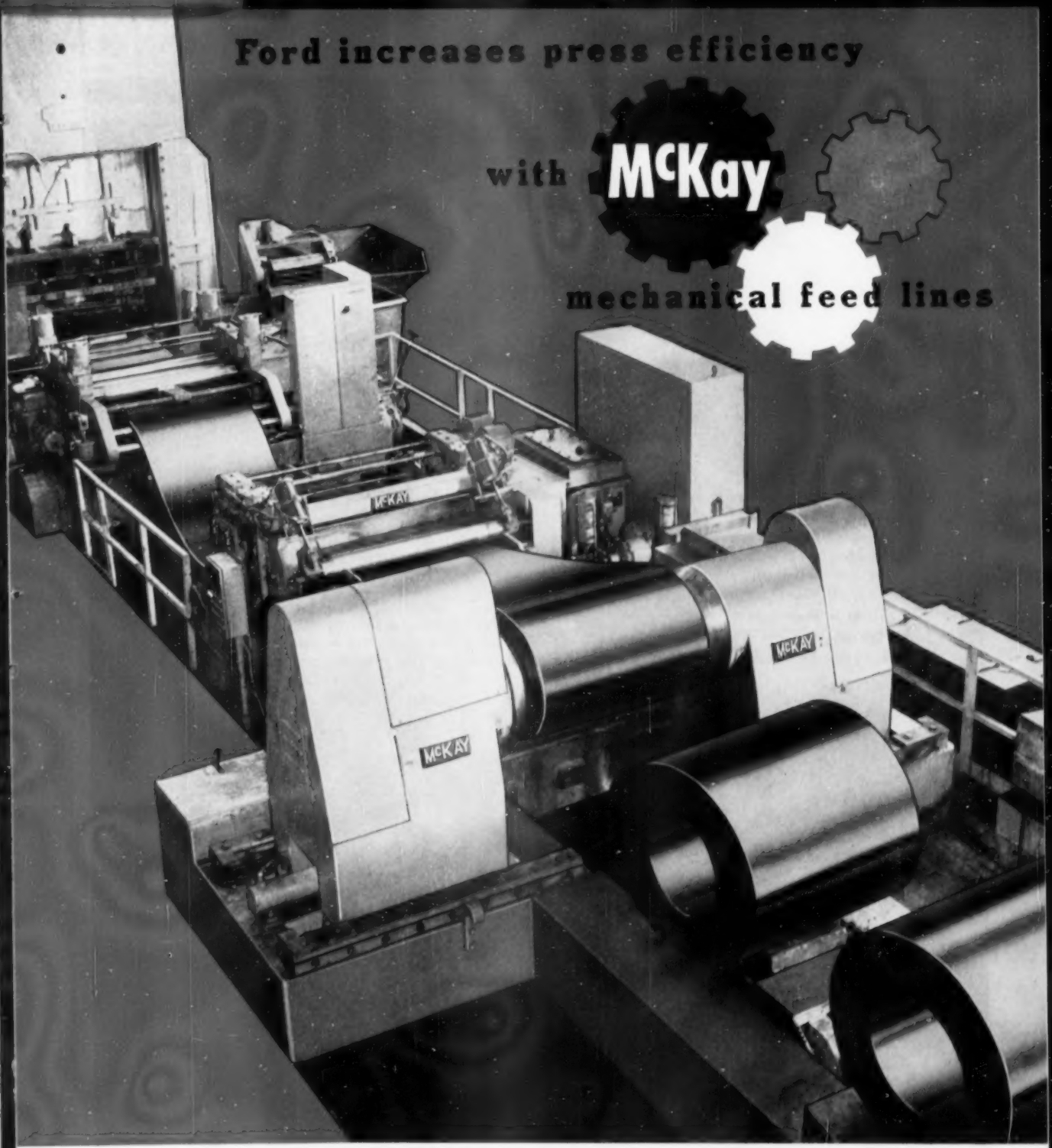
CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

Ford increases press efficiency

with McKay mechanical feed lines



To increase the output and efficiency of large presses the Ford Motor Company has installed a McKay Mechanical Press Feed Line that for the first time successfully cleans, levels, and feeds heavier materials for today's production requirements. Designed to process strip up to 60" in width and 1/8" in thickness, it works equally well on progressive die or blanking presses without overloading. And, because it is floor-mounted with independent drive it can easily be adapted to future production needs.

If you want to increase the efficiency of your press equipment, why not talk with McKay—pioneer and leading producer of press feed and cut up lines.

FREE BOOKLET

Complete illustrated data on McKay Press Feed and Cut Up Equipment will be mailed without charge at your request. Write for it today.

M°K

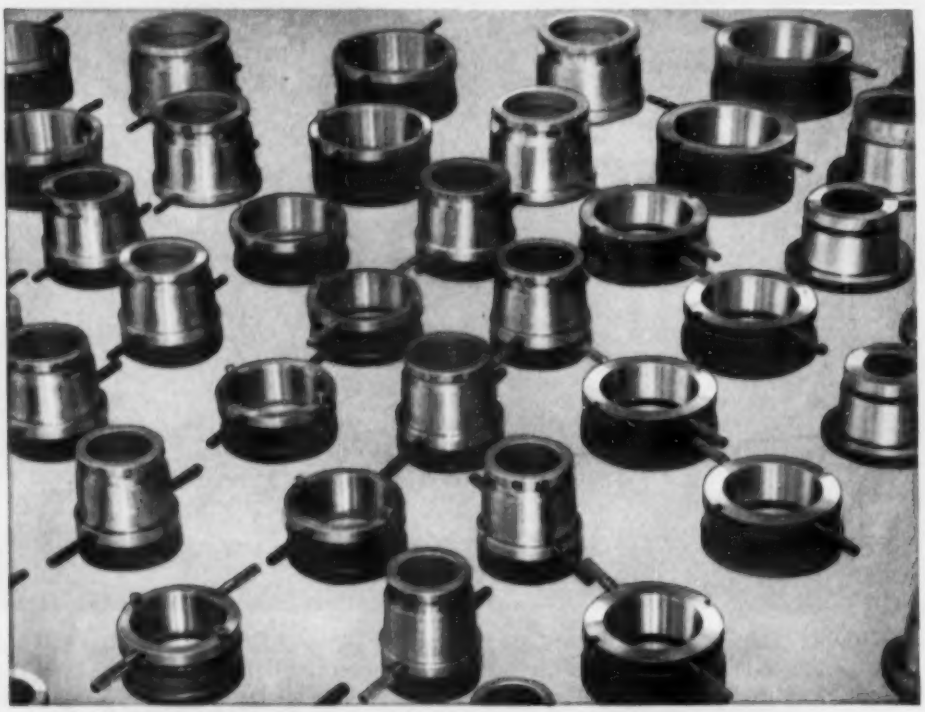
THE McKAY MACHINE COMPANY, Youngstown, Ohio

362

One of the largest producers of pipe and tubing for oil country production has found that its investment in Pipe Machinery gages has paid good dividends. The use of these gages has resulted in improved customer relations as well as reduced their own scrap ratio to the lowest point in their history.

Oil country gages are among the most accurate required by Industry today. The American Petroleum Institute requires that each set of Master gages be certified by the National Bureau of Standards before use.

These gages, which are shipped all over the world, are produced by the same team of highly skilled and dedicated craftsmen who make all our gages. This group of men have but one ideal—producing the most accurate gages possible, resulting in lower costs to you. We can help you with your problems.



THE PIPE MACHINERY COMPANY

29101 Lakeland Blvd. • Wickliffe, Ohio

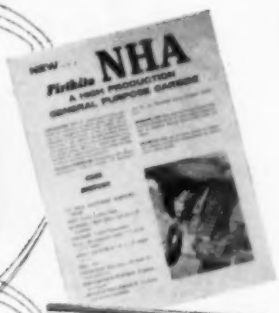
Greater Cleveland

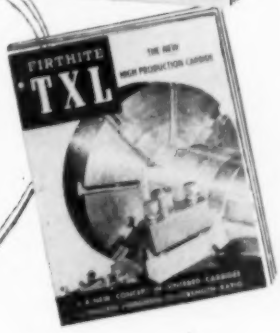
3 New FIRTHITE CARBIDE Grades for high production!

NHA

TXH

TXL





Because of the many new materials and tougher, harder-to-machine non-ferrous alloys and the use of more powerful machine tools, there is an increasing demand for better grades of carbide for economical, high production machining of cast iron, stainless steels, aluminum, brass, copper, etc.

Now, grade NHA, Firth Sterling's newest concept, combines the hardness of precision finishing grades and the toughness of general purpose grades to machine these tougher alloys.

TXH, designed as a heavy duty, general purpose, steel cutting grade, is composed of the exact amounts of alloys necessary to produce the ideal *combination* of hardness, strength, and impact resistance to give maximum performance and tool life as a steel cutting carbide for:

1. High Production, heavy duty, turning, facing and boring on all types of steel.
2. General Purpose, job shop type of work with wide range of use from heavy duty to light cuts with relatively slow to high speeds.

Grade TXL was designed specifically for the machining of steel from finishing cuts to the medium roughing range of operations.

Grade TXL has the highest hardness-to-strength ratio thus far achieved in a cutting grade for the intended range of operations on steel. Because of its unique combination of properties and composition, Grade TXL gives more crater and edge wear resistance than is obtainable in conventional grades in this class.

Mr. Tooley says: Clip and mail coupon today! Don't delay!

Firth Sterling Inc.
3113 Forbes Street
Pittsburgh 30, Pa.

Please send the following technical bulletins, as checked, without obligation.

☐ NHA Bulletin SL 2101 ☐ TXH Bulletin SL 2096 ☐ TXL Bulletin SL 2079

Name_____

Company_____

Address_____

A-328

Firth Sterling

—INC—

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High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

TRADE **Verson** MARK

OFFERS YOU VERSATILITY TO MEET THE BROADEST NEEDS

A typical job at Westlof Tool & Die Co. — die tryout on progressive tooling. The press is also used for die tryout on Transmat type tooling.

Catalog G-57 presents basic data on all types of Verson presses. Write for your copy.

Die tryout for a tool and die shop is probably one of the severest tests of the versatility of a press. At Westlof Tool & Die Co., Detroit, Michigan, a 300 ton Verson double crank, straight side press is used for this purpose.

The press itself incorporates several features which are examples of the versatility Verson engineering can provide: The ram is equipped with three triple bank cushions adjustable right or left to 7" centers. The bed has two large cushions, one right, one left. All cushions are independently controlled. The press is equipped for application of coil feeding equipment should it become necessary. Press speed is variable from 15 to 30 strokes per minute. Power adjustment of the slide is 15".

If your requirements call for great versatility, bring your problem to Verson. For specific recommendations, just send an outline of your needs.

A Verson Press for every job from 60 tons up.

TRADE **Verson** MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9336 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

Here's why...

Ring Punch & Die, Inc. JAMESTOWN, NEW YORK

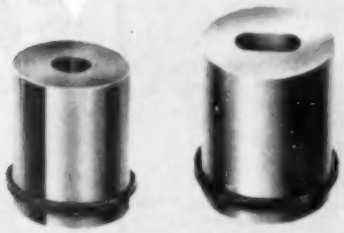
uses Latrobe's

FREE MACHINING HIGH CARBON— HIGH CHROMIUM TOOL STEELS

for Standardized Precision Punches and Dies

TOOL LIFE INCREASED!

Screw machine operation increased from 45 pieces to 80 pieces per hour when machining Latrobe's GSN FM tool steel. In production, the cut-off and form tool life increased over 100% between grinds!



PRODUCTION DOUBLED!

Round hole dies are drilled and taper reamed. Oblong hole dies are milled and counterbored. Again, Latrobe's GSN FM tool steel resulted in savings—production per hour was doubled; cost of drills, end mills and reamers reduced!

EXCEPTIONAL WEAR IN USE!

Exhaustive field tests, conducted by Ring Punch and Die, Inc., have showed that GSN FM punches and dies give exceptional wear in actual production use. No loss of punch life, or chipping, was detected over that normally experienced when punches and dies were made of regular high carbon-high chromium steel without the "free machining" sulphide additives.

GSN FM is an oil hardening high carbon-high chromium steel possessing outstanding non-deforming characteristics in heat treatment. It contains sulphide additives that greatly improve its machinability. These alloy sulphides, as well as the important carbide particles, are evenly dispersed throughout GSN FM by Latrobe's exclusive DESEGATIZED® process of manufacture—your assurance of uniform tool steel quality.

Call your nearest Latrobe representative for complete data on GSN FM and other quality tool steels. A wide range of sizes for immediate delivery stocked at conveniently located warehouses.

Latrobe

STEEL COMPANY

Main Office and Plant: Latrobe, Pa.

Branch Offices and Warehouses Located in Principal Cities

PRECISION CUTTERS!

MADE TO YOUR EXACT SPECS... SOLID CARBIDE, OR CARBIDE TIPPED!

Why put up with stock cutters, when made-to-order cutters cost no more? Cutters designed for specific gang-milling, slotting, venting, slitting or grooving operations in various diameters and thickness to suit YOUR needs exactly. Fast service: all component materials carried in stock. Top-flight reputation for dependability built since 1888. Furnish complete specs, quantities desired and material to be cut when requesting prices. Write for Bulletin No. **52**

W. F. MEYERS CO., INC.; BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-8-250-1

GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills

Stock Sizes:
9/0—14 with Straight Shank
3/0—14 with Morse Taper Shank

Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS - HOAGLUND
Company

400 Main Street, Manchester, Conn.

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Buy THRIFTMASTER

Double Eccentric Adjustable

DRILLHEADS

The only heads of this type standard with

Full Ball Bearing Construction

- greatest flexibility in drilling irregularly spaced holes
- sustained accuracy for trouble-free operation
- 20 Standard Models—3 to 8 Spindles
- Special Models on Order

Makers of
DORMAN AUTOMATIC
REVERSE TAPPERS

Write today for complete information on this *dependable* Double Eccentric Adjustable Drillhead . . . the latest addition to the Thriftmaster line of Single Eccentric Universal Joint Type Adjustable and Special Fixed Center Drillheads.

THRIFTMASTER
Products Corporation
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

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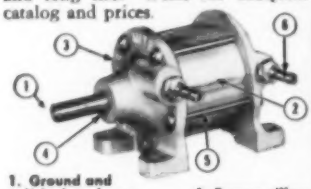
LANCASTER, PA.

USE READER SERVICE CARD; INDICATE A-8-250-2

AIR-MITE AIR CYLINDERS

Low Cost... Compact... Powerful... Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE

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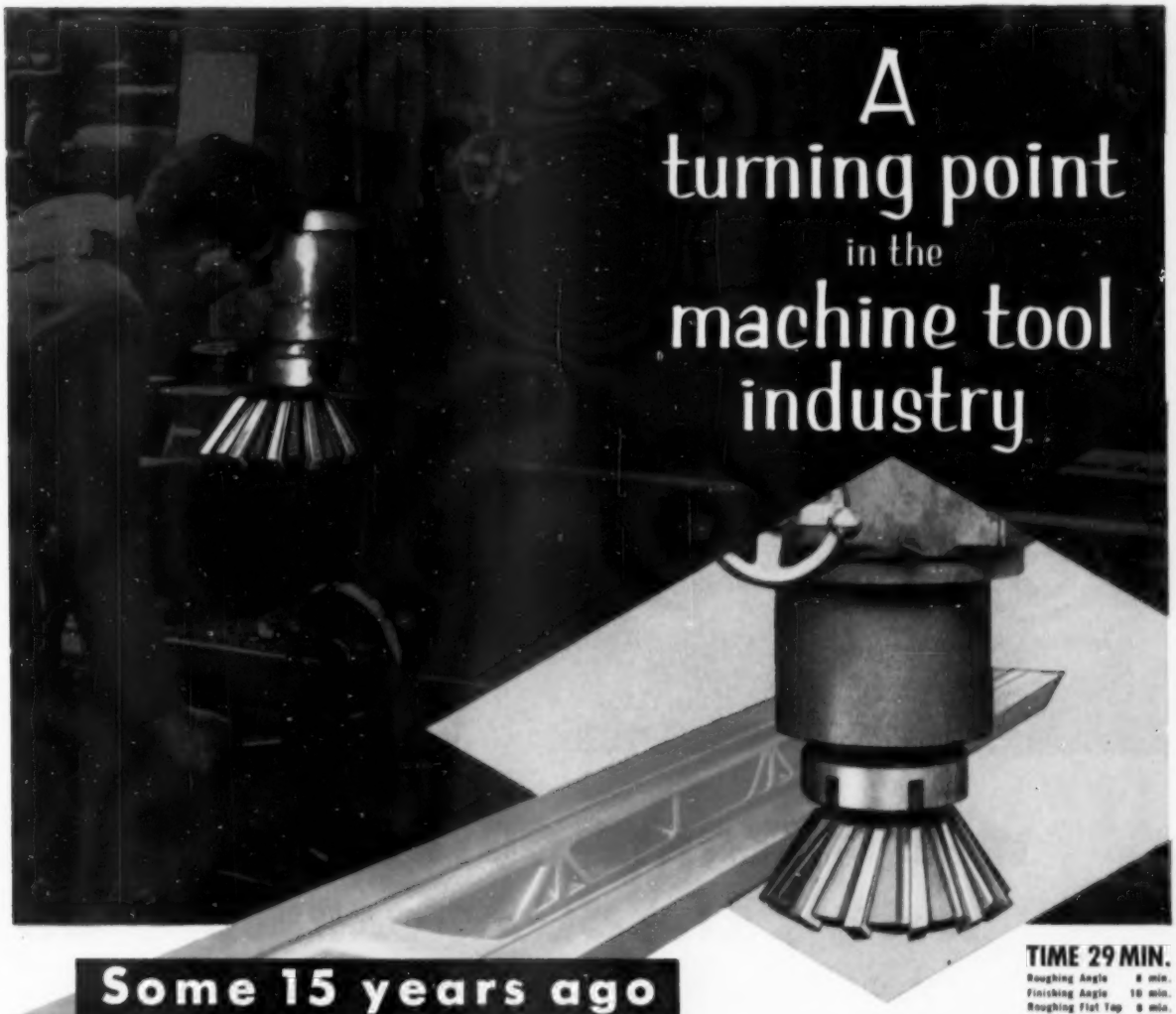

Some 15 years ago

Gould & Eberhardt changed
INCORPORATED

. . . changed from planing and hand-scraping to milling and grinding for finishing their 72-inch long meehanite ram used in 36" Industrial Shapers. At that time, not all G & E people were sold on the idea that this particular part was suitable for milling by the proposed new method, but now it is a different story.

Milling, generally speaking, is four times faster than planing; mechanical grinding is ten times faster and more accurate than hand-scraping. Today surface finish is measured by profilometers in millionths of an inch. Along with these advances came quick-acting clamps, quick-change tool adapters, and faster speeds and feeds.

One of the reasons why G & E is sold on milling is the outstanding performance of O K bevel end mills for both the roughing and finishing cuts. They like the simple way blades are set out one serration and ground when dull and the long run between grinds.

For the free audit of any metal-cutting operation, write for our questionnaire. This data is fed into an electronic computer and you will be astonished at some of the results.

multi-diam tools
reamers
boring heads
counterbores
form cutters
trepanning tools
gang mills

THE OK TOOL COMPANY • 400 Elm Street • Milford, New Hampshire

modern milling cutters *for* modern milling machines

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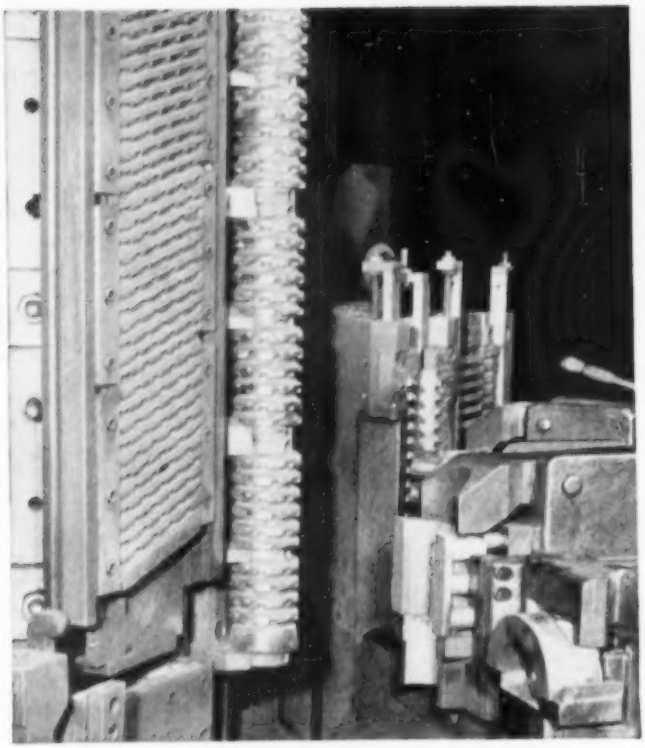


Grade 883 increases broach life 2500%

Highly abrasive cast iron used for this bearing cap at Studebaker caused conventional broaches to fail after maximum run of only 3,600 parts. After the switch to Grade 883, initial broach ran 50 days, produced 90,000 parts without service. Over-all machining costs were reduced 22%.

Grade 370 saves 155 hours' machining time

Normal machining time on this 165-ton cast-steel propeller runner at S. Morgan Smith Co. was 220 hours. Despite abrasive patches, and interrupted cuts, Grade 370 cut machining time to 65 hours – ⅓ the time. At 154 fpm, Grade 370 ran 30 hours without changing – compared to 6-8 hours with previous tools.

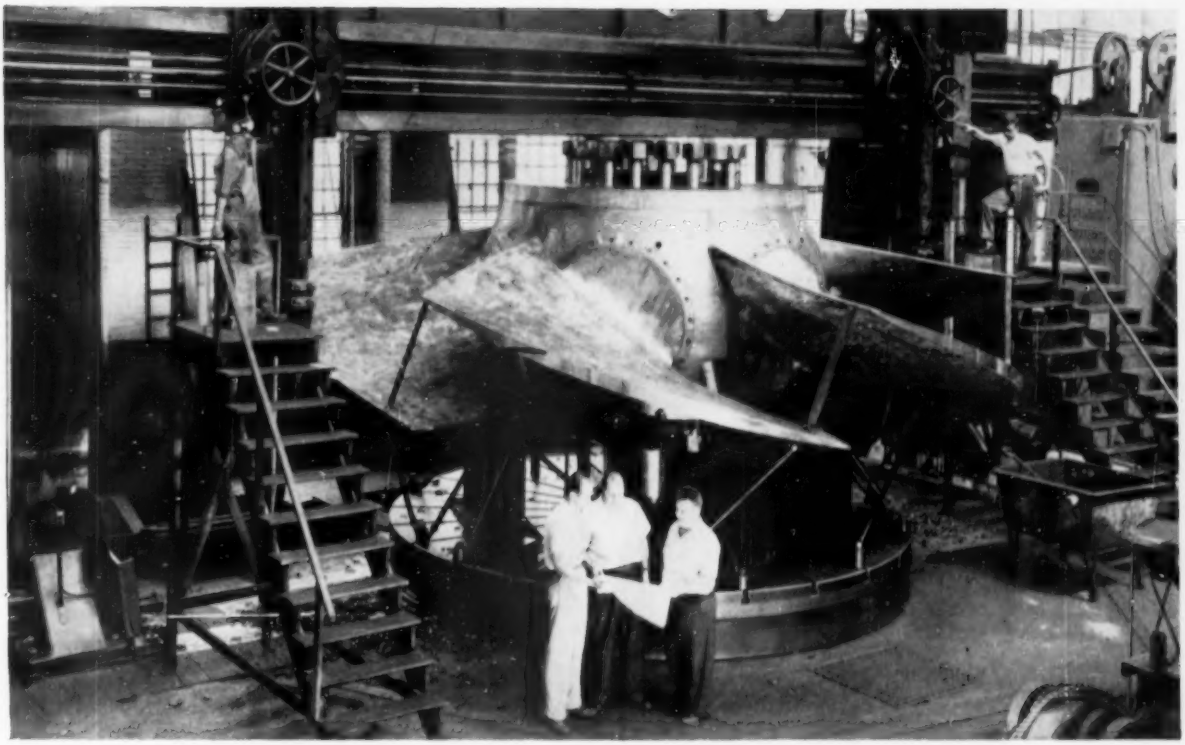
WHY MACHINE OUTPUT GOES UP, WITH CARBOLOY® CARBIDES ON

Grades for cutting every material

Eleven grades to choose from: 300 Series and 78 Series carbides for cutting steel; new Grade 860 for cast iron; five grades for nonferrous machining.

. . . in a form for handling every job

Standard tools in thirteen styles, hundreds of sizes; standard blanks in wide range of styles and sizes. Inserts for Carboloy toolholders or other standard types.



AND UNIT COST COMES DOWN, YOUR METALCUTTING JOBS

- Carboloy cemented carbides are tailored to the job
- Let you cut faster without sacrificing tool life

You'll increase the productivity of your machines, while you reduce total manufacturing cost per piece, when Carboloy cemented carbides go to work on your jobs.

Your machines will be more productive, because they can operate at greater speeds and feeds when tooled with the Carboloy grade designed for the job. And they'll produce more per shift, because Carboloy carbides take rugged machining conditions without sacrifice of tool life.

Your units costs will go down, because the use of these grades means less machining time per piece . . . with lower downtime expense, reduced grinding and maintenance charges.

Proved in the field

Hundreds of inplant case histories like the two shown above prove Carboloy cemented carbides can double and triple output, save thousands of dollars per year in machine time, manpower, and tool costs.

The reason is simple. Each Carboloy carbide grade has cutting characteristics tailored to a particular type of job. Whether you're machining ferrous or nonferrous metals, whether you're taking heavy or finishing cuts . . . one of the eleven Carboloy carbide grades handles the job. And you can quickly get the *grade* you need, in the *form* you need it.

Stocked locally by Carboloy Distributors

Your local Authorized Distributor of Carboloy cemented carbide products stocks standard tools, blanks, inserts, and toolholders in styles and sizes for every job or machine. He'll give you fast delivery, and expert technical assistance.

Call him today (you'll find his name in the Yellow Pages of your phone book). Or write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Street, Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

American Society of Tool Engineers

1958 TOOL SHOW

ASTE

PHILADELPHIA
Convention Center
May 1-8, 1958

For information :

EXPOSITION COMMITTEE
American Society of Tool Engineers
10700 Puritan Ave., Detroit 38, Michigan
UNiversity 4-7300

NOW—Put a Set of Gage Blocks in the hands of each of your machinists

MEMO TO MANAGEMENT:

PUT YOUR SHOP ON A SINGLE MEASUREMENT STANDARD

A significant improvement for complete and over-all Quality Control in your plant is now practical and reasonable in cost.

It is of such value that many companies have decided to equip their toolmakers, machinists and inspection personnel with a personal set of the DoALL Shop-Blocks. Product quality goes up—waste and re-work costs are reduced.

In a cooperative program for companies who have taken this interest we have established, for a limited period, quantity discounts to make this "single measurement standard" possible in any size plant.

We urge you to consider this for your plant.

It can prove to be one of your *best* investments.

NEW

DoALL

SHOP-BLOCKS

DoALL Shop-Blocks meet the realities of today's precision tolerances required right at the bench, job or machine. They represent DoALL's decision to completely discontinue manufacture of B grade blocks as inadequate for today's dimensional control needs. They provide working accuracies that will save you valuable time, effort and waste . . . give better control needed for shop measurements.

"A" Grade Working Gage Blocks at less than "B" Grade Prices

Accuracy:	+ .000006"
	− .000002"
Finish:	0.8 AA or better
Flatness:	.000004"
Parallelism:	.000004"
Hardness:	65 Rc

The Only "A" Grade Working Gage Block Available Today!

These blocks are available from stock today. Ask for literature. Call your local DoALL Store, or write.

The DoALL Company,
Des Plaines, Illinois

SET NO. 860
84 pieces
Only $265.00*

.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—49 Blocks .101" thru .149"
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1.000" Series—4 Blocks 1.000" thru 4.000"
Quarter tenth Series—3 Blocks .100025", .100050", .100075"

SET NO. 380
36 pieces
Only $130.00*

.0001" Series—9 Blocks .1001" thru .1009"
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.100" Series—5 Blocks .100" thru .500"
1.000" Series—3 Blocks 1.000", 2.000", 4.000"
Half tenth Series—1 Block .10005"

*Discounts on purchase of 10 and 50 or more sets.
*.050" or .100" steel or carbide wear blocks available at slight extra cost.

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Call Your DoALL Service-Store

You CAN
take it with you
. . . or use it in the shop

THE VERSATILE
WELLS 49A
METAL CUTTING
BAND SAW

As a horizontal cut-off saw

As a vertical band saw

Use the Wells 49A in the shop, or take it to the "job-site"—you'll find it an efficient tool—a time and money saver on a wide variety of metal cutting jobs.

As a horizontal cut-off tool it has a capacity of 3½" x 6". One easy motion converts it to a vertical band saw. No tools required! Just swing the head into upright position—it's ready to use. Cut angles, slots, do light contour work.

Get TWO saws for the price of ONE! Write for complete information.

Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
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THIS **REVERSE** STAMP

IS A FORWARD STEP!

Hoggson Brand Reverse Stamps are designed for stamping molds for making rubber, plastic and glass products and for marking die sinking molds and forming dies.

Made of high alloy steel, specially heat treated to withstand continuous impact, they are made for marking flat or contoured surfaces, and are GUARANTEED ACCURATE.

Available from stock in letters and figures from 1/16" to 3/8", Hoggson Brand Reverse Stamps are also supplied, hand cut to your order, as symbols, trademarks, or other special designs.

Specify Hoggson Brand Reverse Stamps. They're a step in the right direction!

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milling cutter Arbors

• made of alloy steel, heat treated for maximum toughness • precision ground to ensure concentricity of nose and taper shank • hardened drive keys securely held by cap screws • replaceable in case of damage

Flywheels

• Improve milling cutter performance • Increase cutting blade life • available in three styles, for mounting on the spindle of any machine

Write for Catalog No. 33

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Stops Losses making Dies and Templates

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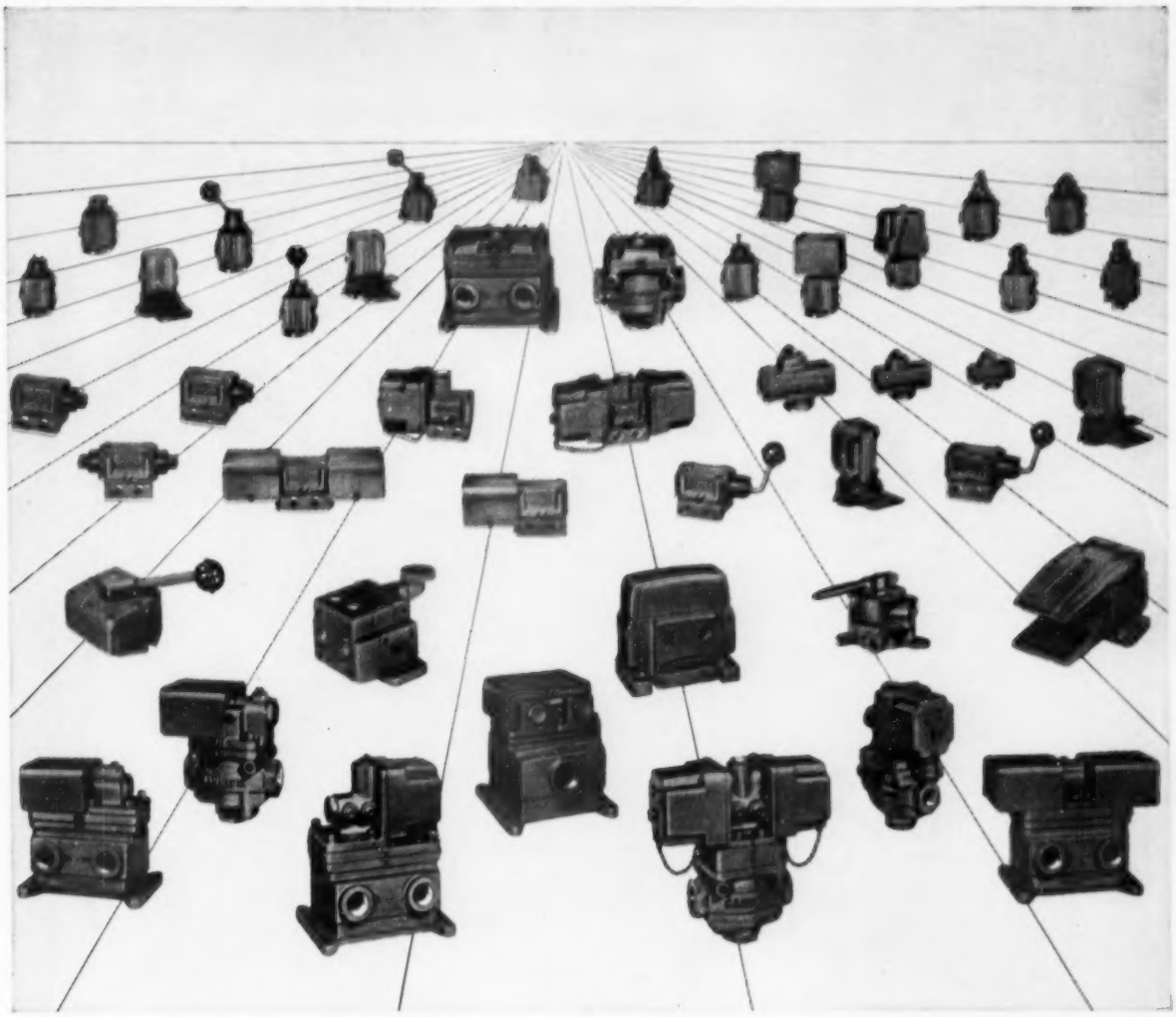

These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

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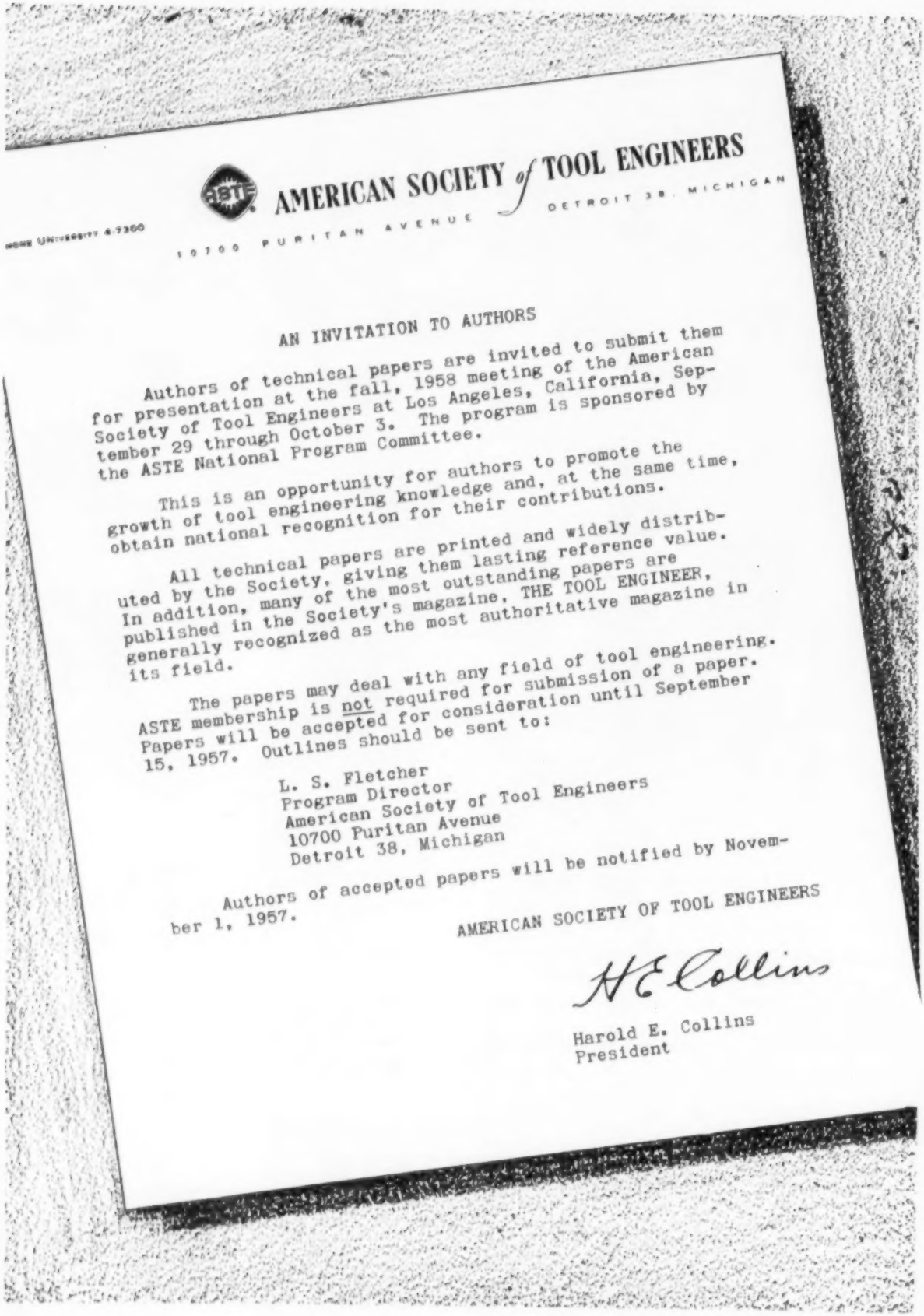
VALVES

***For this complete catalog** showing all the Hannifin directional air control valves, write to Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.*



AMERICAN SOCIETY of TOOL ENGINEERS

10700 PURITAN AVENUE DETROIT 38, MICHIGAN

WORTH UNIVERSITY 4-7200

AN INVITATION TO AUTHORS

Authors of technical papers are invited to submit them for presentation at the fall, 1958 meeting of the American Society of Tool Engineers at Los Angeles, California, September 29 through October 3. The program is sponsored by the ASTE National Program Committee.

This is an opportunity for authors to promote the growth of tool engineering knowledge and, at the same time, obtain national recognition for their contributions.

All technical papers are printed and widely distributed by the Society, giving them lasting reference value. In addition, many of the most outstanding papers are published in the Society's magazine, THE TOOL ENGINEER, generally recognized as the most authoritative magazine in its field.

The papers may deal with any field of tool engineering. ASTE membership is not required for submission of a paper. Papers will be accepted for consideration until September 15, 1957. Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by November 1, 1957.

AMERICAN SOCIETY OF TOOL ENGINEERS

H E Collins

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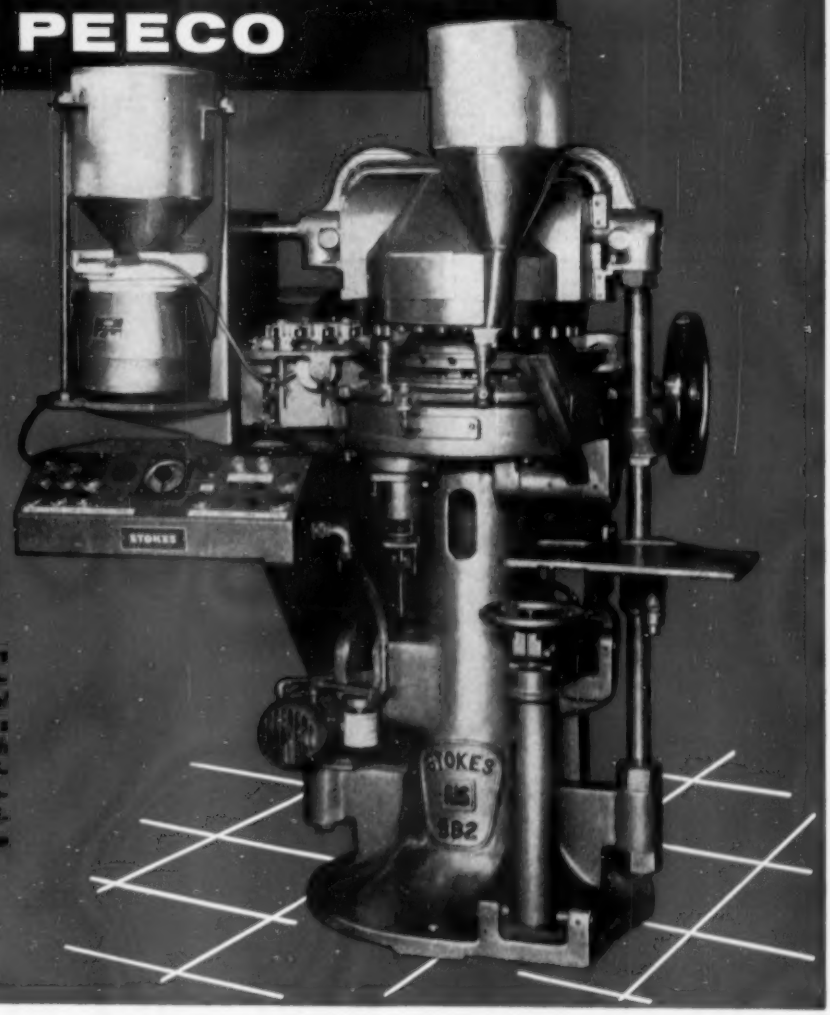
President

production equipment produces MORE with PEECO



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NOW developed PEECO feeders are included on STOKES pharmaceutical equipment. The Model 538 Mark II (illustrated) produces press coated tablets with a high degree of uniformity and precision at rates up to 750 per minute. Tablet cores are fully oriented, without dusting within the PEECO feeder bowl.

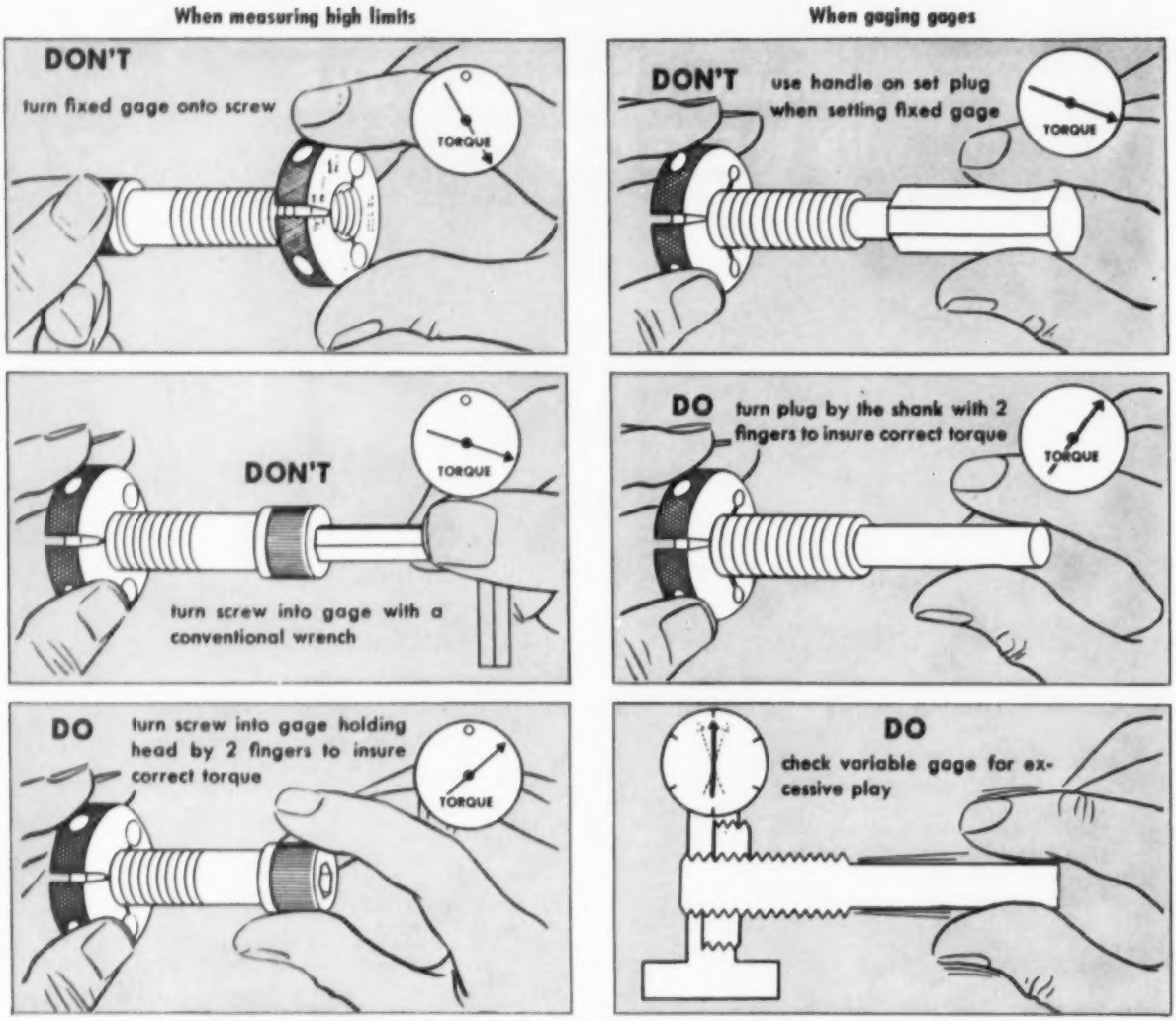
PEECO'S leadership in the field of vibratory parts feeders has contributed much in helping increase the capacities of new production equipment in various markets. We are glad to include among the companies now being served by PEECO, F. J. Stokes Corporation of Philadelphia, Pennsylvania, manufacturers of pharmaceutical equipment for two-thirds of a century.

If you want to produce more, send for bulletin No. 365 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

Peeco PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. A DIVISION OF AUTOMATION DEVICES, INC.



These illustrations from new SPS booklet show some of the do's and don'ts of gaging precision threads.

3A threads: what they are; how to gage them — new SPS booklet tells all

Threads made to Class 3A fit are the most precise in general use in industry. But you do not always get the 3A precision you specify. Because of many different gaging techniques that yield varying results, screws with threads well outside the Class 3A tolerance limits often pass inspection.

SPS has prepared a new booklet on this subject. It explains clearly what Class 3A threads are and the pros and cons involved in the widely varying gaging techniques in use today. It reviews the gaging of high and low limits of 3A threads, sampling techniques, and even the methods of gaging gages.

All standard UNBRAKO socket screw products fall within specified tolerance limits *no matter what method is used to gage them.* Leading industrial distributors carry complete stocks. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

We also manufacture precision titanium fasteners. Write for free booklet.

Form 2239, "Class 3A Threads: what they are; how to gage them." 16 pages, with many illustrations. Write for free copy today.

STANDARD PRESSED STEEL CO.

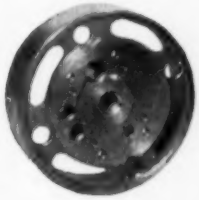
UNBRAKO SOCKET SCREW DIVISION SPS

JENKINTOWN PENNSYLVANIA

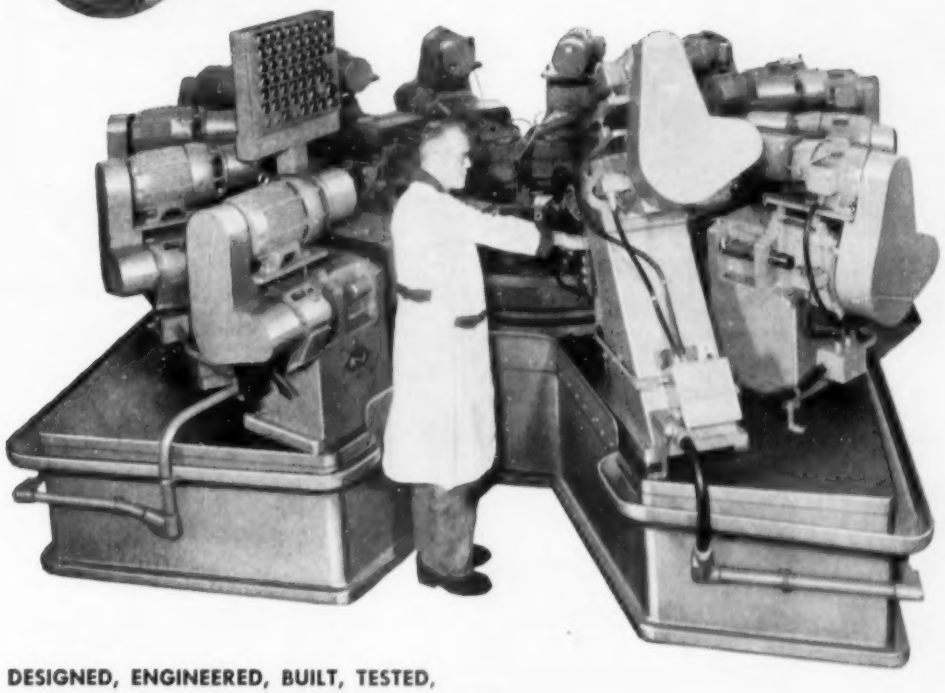
BEFORE

R-J MACHINE NO. 1249

REHNBERG-JACOBSON



AFTER



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This 14-station machine was designed with a number of things in mind. It was tooled at the factory for the piece shown above—a compressor front head requiring 14 holes (8 of which are tapped) and two milled slots. A variant of the piece goes through the same tools, with selected spindles cut out by push-button controls. Later, the owner of the machine is going to retool it for two other pieces. It consists of standard R-J Drill Units and Tap Units with an Index Unit to hold the fixtures, all mounted on a firm and sturdy base, with suitable automatic and manual controls to suit the requirements. The machine is cycled for 276 pieces per hour. *This is a good example of the type of production machine that Rehnberg-Jacobson is well-equipped to design and produce.*

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AND PRODUCTION CONSULTANTS

ACCURACY .0002 T.I.R.

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SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

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HAVE YOU CHECKED YOUR *COUNTERSINKING COSTS* LATELY?

A *Severance* CARBIDE ECONO-SINK WILL GIVE YOU —

- INCREASED ACCURACY
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- SMOOTHER SEATS
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Chatter-Free Design

Solid Carbide Cutting Heads

Make the Switch to Carbide BEFORE IT'S TOO LATE

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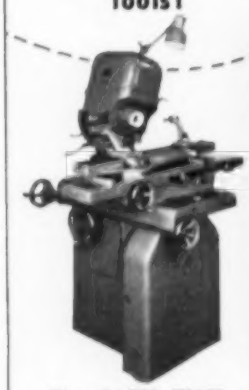

THE *Cawi* W&H TOOL and CUTTER **GRINDER** with Patented Grinding Head

The CAWI W&H offers exact, accurate clearance angle by *direct reading* from a simple, legible, graduated scale. Requires no mathematical tables or complicated computations.

- **Insures longer tool life.**
- **Utilizes *entire* width of grinding wheel, thus lengthens wheel life.**
- **Achieves superior grinding finish.**
- **Cuts cost by greatly reducing set-up time.**

New patented Grinding Head simplifies work of operator, reduces work time, increases productivity.

Write for special bulletin giving full details and description.

CAWI MACHINE CO., INC.

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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTSERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 167.

Improve Monday morning efficiency—switch to STUART SOLUBLE OILS with guaranteed longer service life!

Anaerobic bacteria (present in practically all machine shops) thrive in your water-mix cutting and grinding fluids and generate that expensive perfume known as "Monday Morning Odor." Expensive because it's a sure sign the stability of the compound is being damaged—service life shortened—and because your workers' efficiency is bound to suffer.

So regardless of your experience with other bactericides, it will pay you to try Stuart's heavy-duty soluble cutting and grinding compounds with the anaerobic bacteria inhibitor that's *guaranteed* to keep the emulsion stable and sweet three to four times longer than other water mixtures . . . even in hot weather and through long shutdowns when bacteria multiply fast.

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Talk the problem over with your Stuart engineer and place a trial order for Solvol "X," Codol "X," Dasco Super Soluble "X" Base, or new general-purpose Dasco D-20—whichever of these top-quality, heavy-duty cutting and grinding compounds best fits your needs. D. A. Stuart Oil Co., Limited *guarantees your complete satisfaction* with the bacteria resistance of these compounds, on a money-back basis ! Phone your Stuart Service Center . . . before "Monday Morning Odor" hits your plant for another efficiency loss.

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Arrange now to test Stuart's water-mix cutting and grinding fluids on your difficult machining jobs.

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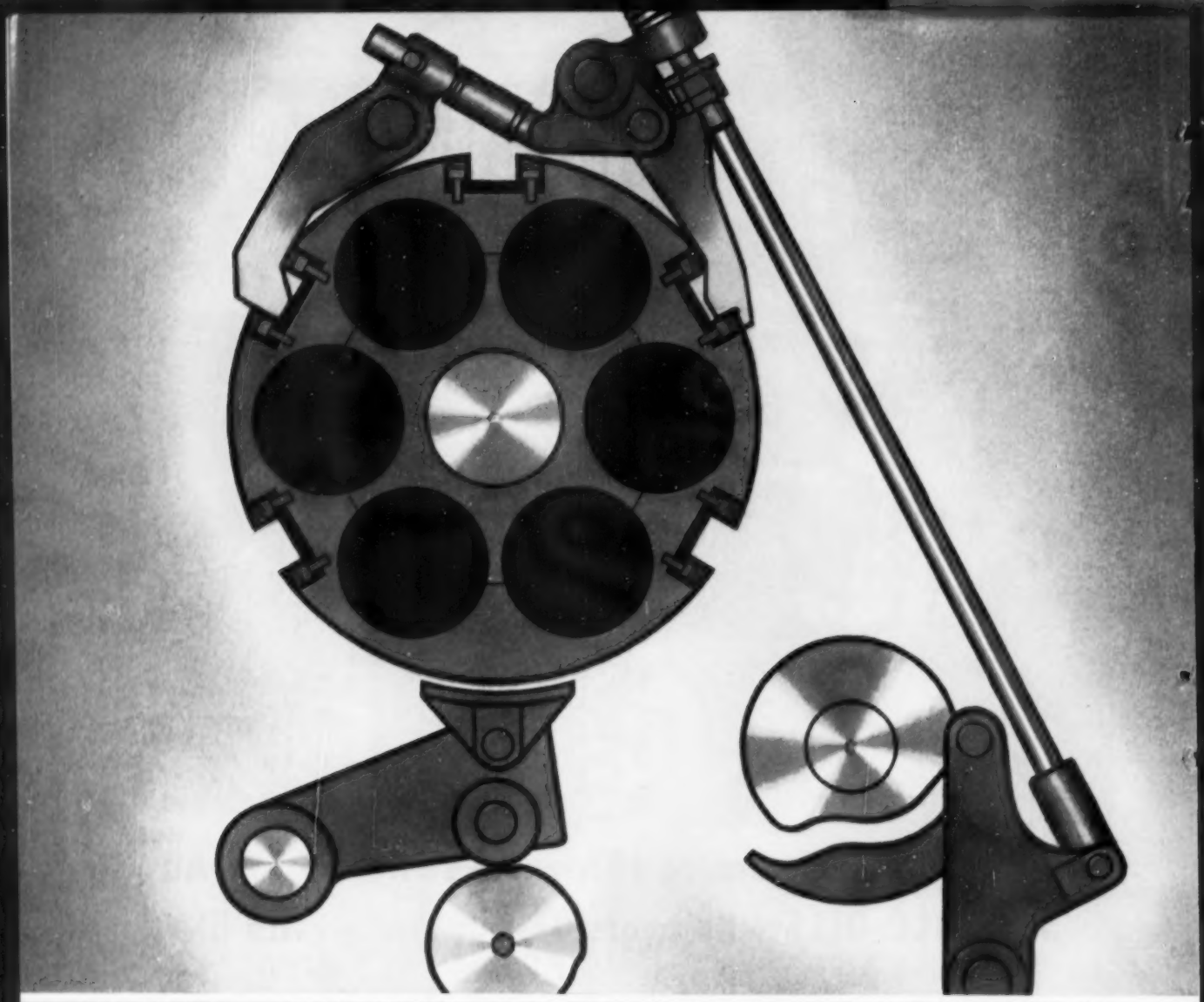


heavier, faster cuts

with accuracy

This cross section of a New Britain spindle carrier illustrates three features that assure permanent accuracy under today's constant heavy duty use.

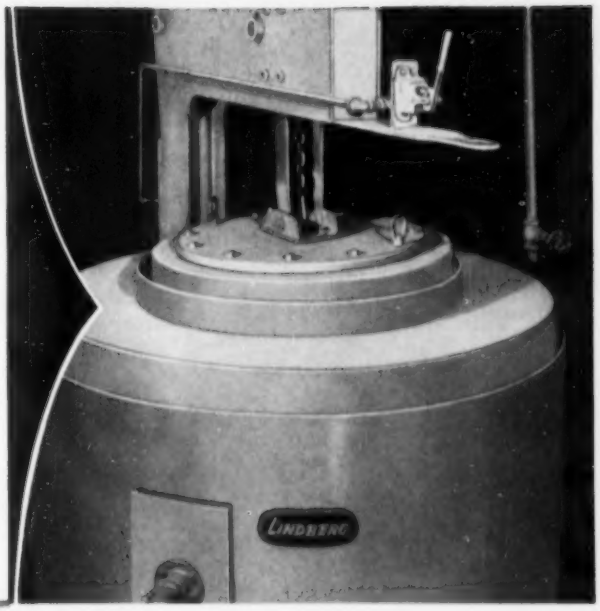
1. Positive, accurate location of the carrier means perfect spindle alignment with the tool.
2. Rigid clamping of the carrier makes it integral with the frame during the cutting cycle, eliminating carrier weave and vibration.
3. Automatic spindle carrier lifting mechanism eliminates all wear during indexing, and so guarantees preservation of initial accuracy.

Features like these don't show on the surface — you "see" them in the form of continued accurate production, year after year. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

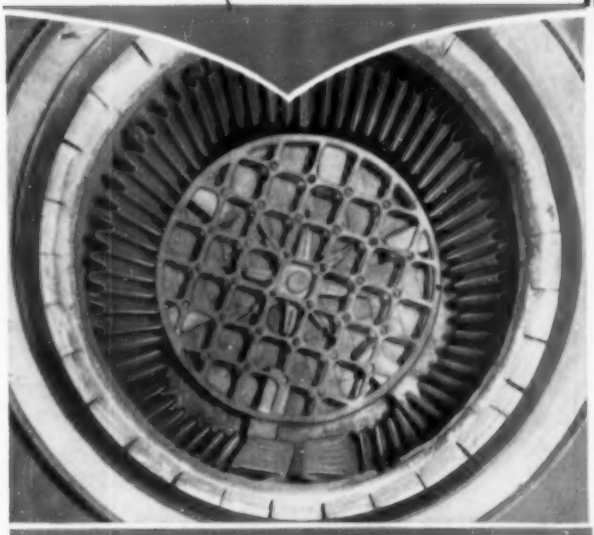
THE NEW BRITAIN MACHINE CO.
Automatic Bar Machine
NB

FROM THE OUTSIDE

. . . JUST ANOTHER LINDBERG PIT-TYPE CARBURIZING FURNACE



BUT LOOK INSIDE

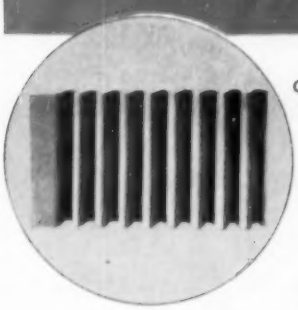


No Retort!

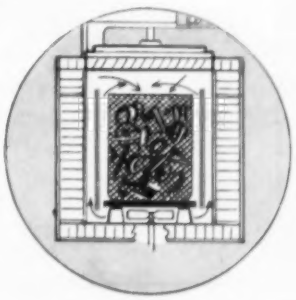
Because it needs no retort, this new Lindberg electric vertical pit-type furnace gives you these important advantages:

- **Lower initial cost, no retort to pay for.**
- **No expensive retort replacement.**
- **Downtime for retort replacement eliminated.**
- **Increased production because it heats faster.**
- **Exact atmosphere control maintains work quality.**
- **Versatile, carbon-diffusing and requenching along with carburizing. Adaptable to variety of work.**

All this is made possible by Lindberg's new CORRTHERM electric heating element. For lower initial cost, lower maintenance costs, faster production, better quality control, why not look into this furnace. It's additional evidence that, if you're concerned with the application of heat to industry, better talk it over with Lindberg.



CORRTHERM elements operate on extremely low voltage. No leakage through carbon saturation. Shock or short hazards eliminated. No complicated mountings required. An exclusive Lindberg development.



Note how CORRTHERM elements serve as baffles to direct forced convection streams through the charge.

LINDBERG
ENGINEERING COMPANY

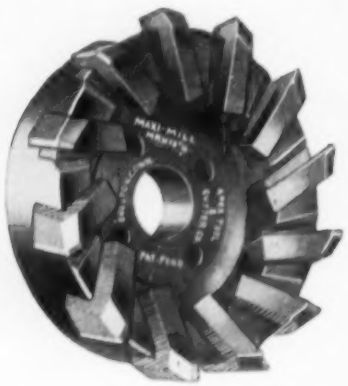
2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.
Toronto Plant: EFCO-Lindberg, Ltd., 11 Front Street, East

APEX TOOLS

"APEX" HEAVY-DUTY CUTTERS IN STOCK

We carry stock cutters for face milling, slotting or straddle milling. Your inquiries invited.



"APEX" manufactures inserted tools and milling cutters of all styles. Carbide-tipped cutters furnished when required.

APEX TOOL & CUTTER CO., Inc., Shelton 16, Conn.

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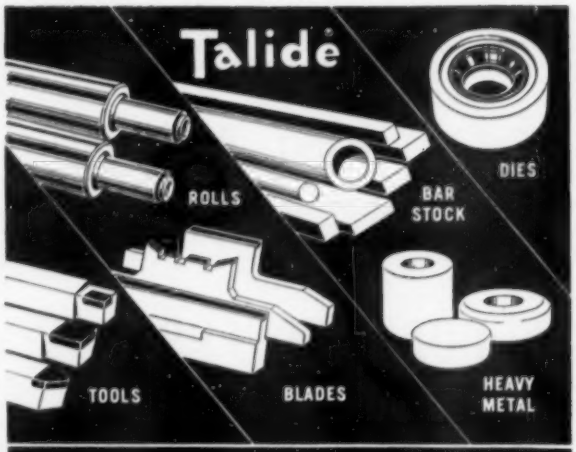

HARDEST MAN-MADE METAL!

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

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TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
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OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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New midget tools for high speed precision grinding

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PNEUMATIC DIE GRINDERS

Perform the most intricate portable grinding jobs quicker and easier with these lightweight, easy-to-hold, air-powered grinders. They operate with a wide range of grinding and filing tools . . . have plenty of speed and power for fast, smooth cutting of hardened steels.

Airetool Midget Grinders are vibration free . . . quiet running . . . won't heat up. Ball bearing thrust and spray lubrication assures long trouble-free service.

Send for details on Airetool Pneumatic Tools: Midget Grinders, Horizontal and Vertical Grinders, Drills, Screwdrivers and Nutrunners.

Model 200
60,000 R.P.M.
⅛" dia. x 4⅞" long
Wt. 4 oz.

Model 300 ——→
38,000 R.P.M.
1¼" dia. x 5⅜" long
Wt. 12 oz.

Over 27 years experience in pneumatic motor equipment.

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AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

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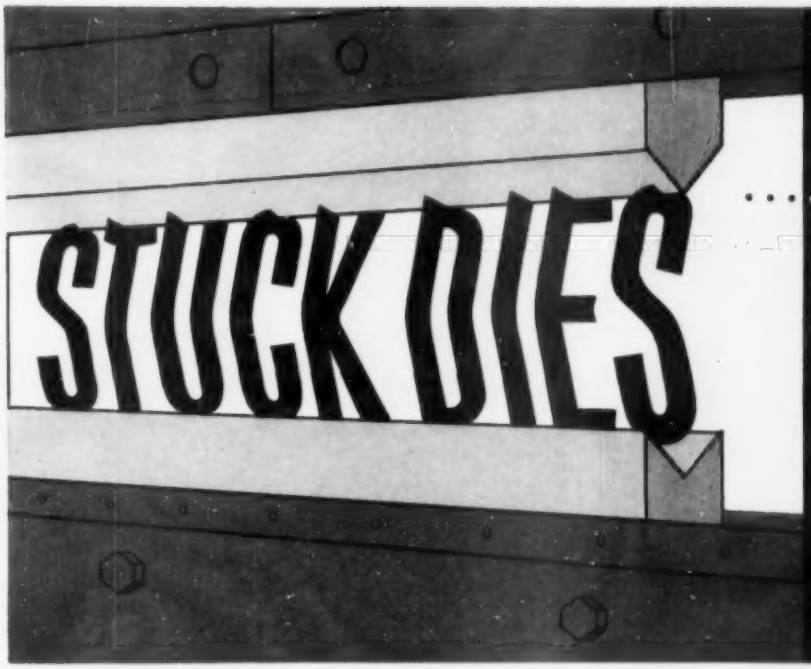
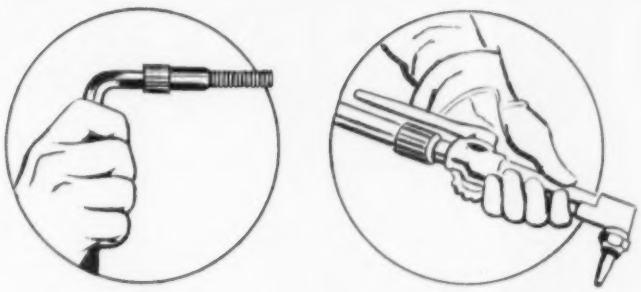
TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 167.



STUCK DIES

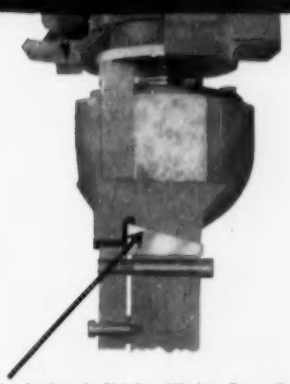
. . . . quickly, easily released with exclusive patented LODGE & SHIPLEY

WEDGE TYPE RAM PRESSURE RELEASE



THIS . . . NOT THIS!

- Use wrench . . . . . not a cutting torch
- in minutes . . . . . instead of hours
- without damage . . . . die holder destroyed

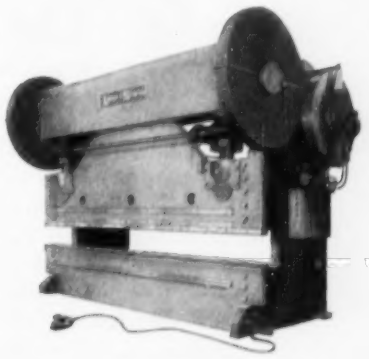


The Lodge & Shipley Wedge Type Ram Pressure Release is unusually simple and rugged in design. A heavy steel wedge has a top angle that complements a similar angle on the base of the ram pittman socket housing. Held securely by a heavy steel plate, the wedges can be released quickly to provide up to ¼" additional clearance.

When a press brake is stalled due to improperly adjusted dies . . . do you face a short delay or near disaster?

With a Lodge & Shipley Press Brake, release of the stuck dies is a quick, simple, non-destructive matter as described in the accompanying detail.

This is but one of many outstanding Lodge & Shipley Press Brake features designed for fast, accurate, efficient and dependable press brake operation. New literature gives complete details. Write: **The Lodge & Shipley Co., 3077 Colerain Ave., Cincinnati 25, Ohio.**



Lodge & Shipley . . . *your Lodge-ical choice*

Hamilton 400-ton 2-point eccentric press

Hamilton 500-ton 4-point eccentric press

Hamilton mechanical presses spell the maximum in versatility

No matter what your press requirements are, you probably won't have to incur the extra expense of special designing and "tailor-made" manufacturing if you explore the versatility of the two basic Hamilton press designs pictured above.

The Hamilton 400-ton 2-point eccentric press represents our conventional design, meeting all the basic needs of stamping plants all over the world. And it is so designed that many optional features may be readily added to transform it into a press capable of doing more highly specialized work.

Extra features include automation equipment, air and electric controls and outlets, die lights, die safety blocks, built-in uprights, provision for feeds, inbuilding and automatic circulating oil lubrication. These features are built into the 4-point press shown above. Let your Hamilton sales engineer discuss your needs with you.

Hamilton Division Hamilton, Ohio

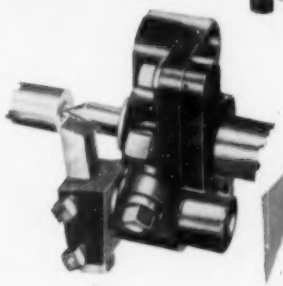
BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools

R and L TURNING TOOL

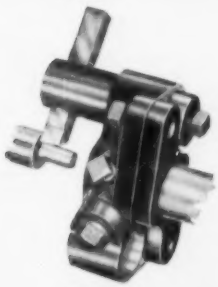
REPLACES AN ASSORTMENT OF 14 TOOLS!

The R and L Turning Tool can be changed from right to left in 10 seconds, and vice versa . . . It is guaranteed not to bend or give way in any manner.



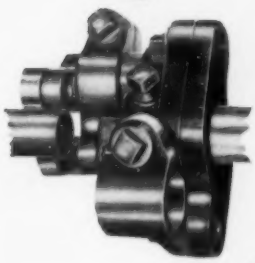
R and L Turning Tool used as BALANCING TURNING TOOL

R and L Turning Tool used as CENTERING & FACING TOOL



R and L Turning Tool used as KNEE TOOL

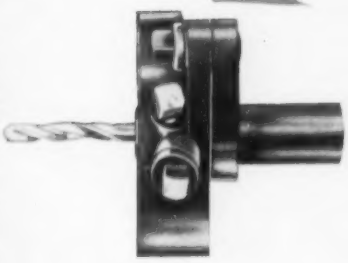
R and L Turning Tool used as BACK REST

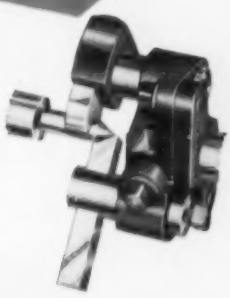


R and L Turning Tool used as ROLLER BOX TOOL

R and L Turning Tool used as FLOATING DRILL HOLDER

R and L Turning Tool used as POINTING TOOL





YOU SAVE ON YOUR ORIGINAL INVESTMENT

Roller Box Tool	$77.00
Centering and Facing Tool	22.00
Knee Tool	37.00
Pointing Tool	36.00
Back Rest	29.00
Floating Drill Holder	14.00
Balancing Turning Tool	52.00
	$267.00
Same for left hand	$267.00
	$534.00

One R and L TURNING TOOL of a similar size (No. 1) costing only $96.50 will take the place of the above assortment of tools!

Write for complete catalog of R and L Tools

R and L TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

OTHER FAMOUS R and L TOOLS:

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

HELIARC Welding
finds satellite jobs are right in its orbit

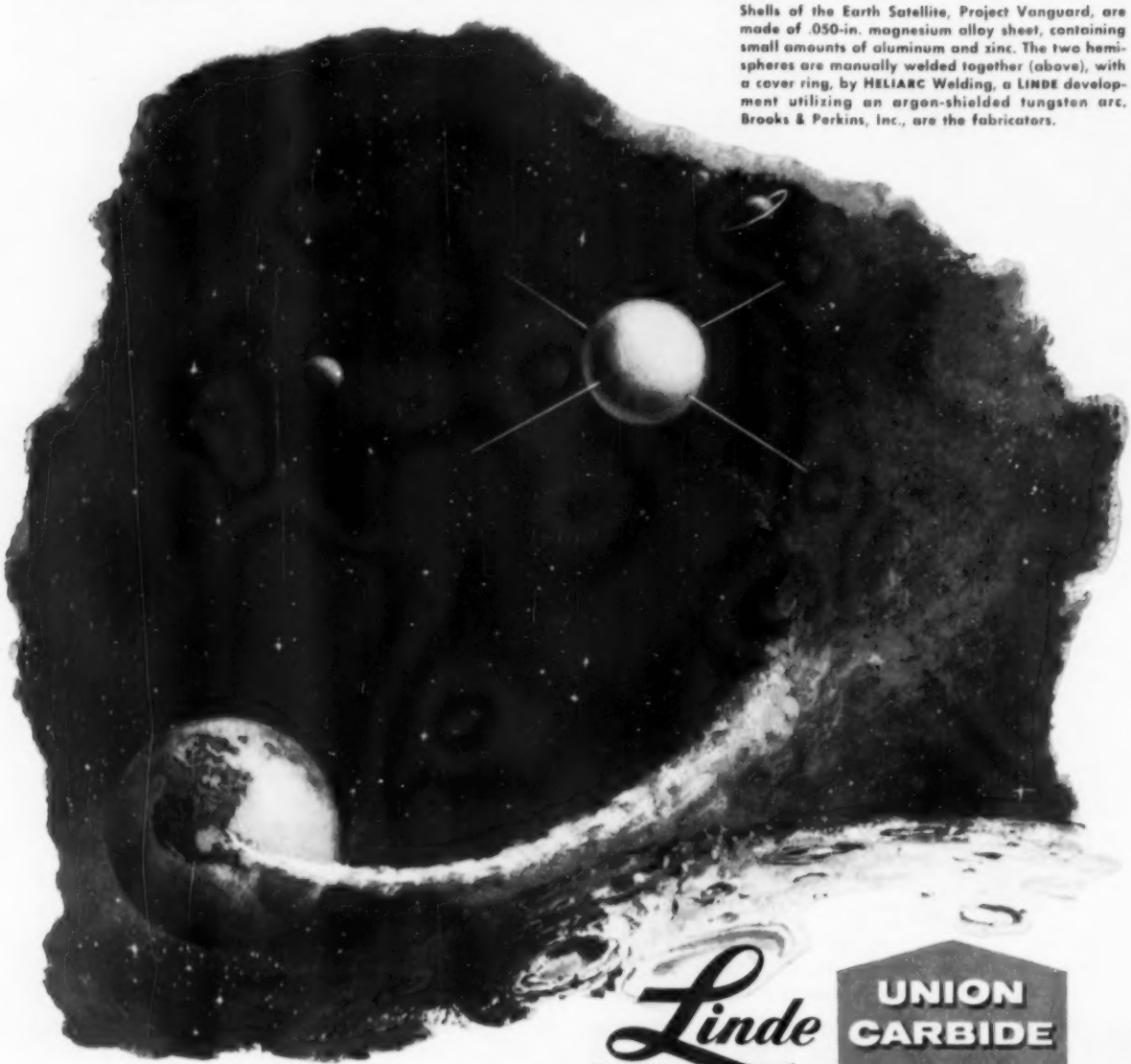
Welding together sections for an earth satellite, under the most exacting specifications, may not be your particular problem. But if welding light-gage, hard-to-weld metals is slowing up your production—LINDE's HELIARC Inert Gas Shielded Arc Welding, using LINDE Argon as a shielding gas, may be just what you've been looking for.

HELIARC Welding is LINDE's method for high-speed fusion of commercial metals, automatically, or manually in all positions. LINDE Argon, guaranteed 99.99% pure, protects the weld. It is readily available, in cylinders or in bulk, from convenient sources all over the nation.

Get more information about HELIARC Welding and LINDE's other modern welding methods. For a free copy of the booklet, "Modern Methods of Joining Metals," address Dept. TE-8, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

FOR THE BEST IN ELECTRIC WELDING—LOOK TO LINDE!

Shells of the Earth Satellite, Project Vanguard, are made of .050-in. magnesium alloy sheet, containing small amounts of aluminum and zinc. The two hemispheres are manually welded together (above), with a cover ring, by HELIARC Welding, a LINDE development utilizing an argon-shielded tungsten arc. Brooks & Perkins, Inc., are the fabricators.



Linde TRADE MARK — UNION CARBIDE

The terms "Linde," "Heliarc" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

A Multipress case study

Multipress, used here for staking chromium-plated pepper mill lids, saves 11¢ per unit for specialty manufacturer.

MULTIPRESS saves specialty manufacturer 11¢ per unit

By using a Denison hydraulic Multipress equipped with simple interchangeable tooling, The George S. Thompson Corporation, South Pasadena, California, manufacturer of the Olde Thompson line of pepper mills and gourmet accessories, is now saving 11¢ on each pepper mill produced.

Previous methods for three sub-assembly operations cost the company 15¢ per unit. With the hydraulic Multipress, costs for these three operations have been reduced to 4¢ per unit. In addition to this significant cash savings, rejects have been virtually eliminated and production has been substantially increased.

The interchangeable fixtures on the index table permit the Multipress to be used for short-run jobs. Downtime for changeover is eliminated.

Learn how Multipress can reduce your production costs. Write Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.

Write for Datalog ASY-5 describing this money-saving method.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

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August 1957 Issue

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is tested on the stock
it is designed to feed...

therefore

BENCO *guarantees* satisfactory operation in your machines

BENCO PUSHERS

Benco Pushers and Feed Fingers are made of oil hardened, non-warping tool steel heat treated by precision methods. As a result each point, from the thread to the bearing area, has the proper degree of hardness while the central section is spring tensioned.

It's this combination of accurate tempering and tension that gives every Benco Pusher and Feed Finger its longer life and superior performance. Each one is rigidly inspected and tested before it leaves the plant.

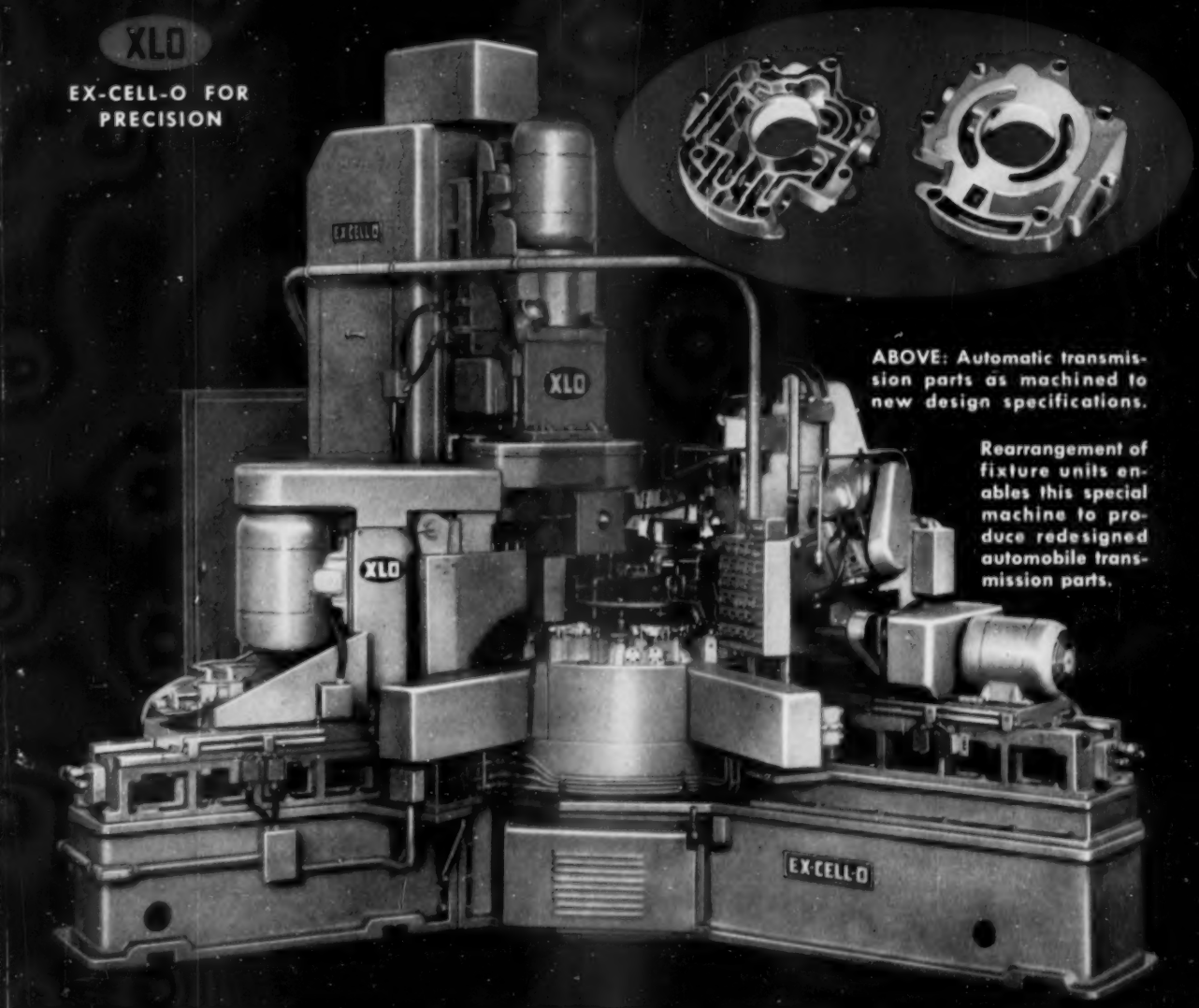
Benco makes the most complete line of Feed Fingers and Master Pushers. Each provides the maximum production economies when properly used... regardless of the type or shape of stock or machine you operate. Standardize on Benco for best results.

Conventional Pusher | Heavy Duty Pusher | Squirrel Cage Pusher | "Multi-Split" Feed Finger | Master Pusher

BENCO COLLET MANUFACTURING CO.
Cleveland 14, Ohio

XLO

EX-CELL-O FOR PRECISION



ABOVE: Automatic transmission parts as machined to new design specifications.

Rearrangement of fixture units enables this special machine to produce redesigned automobile transmission parts.

Parts changes didn't obsolete this special

Easily Adapted to Altered Workpieces

The first big parts change to come along will obsolete many a special machine—at a drastic cut into the production budget! But not so with this Ex-Cell-O special now operating at full tilt in an automobile plant in Detroit.

Built to process regulator valve bodies for automotive transmissions, this special machine was flexible enough to adapt to certain changes in tooling and operational cycles. Right now, it's turning out complicated parts at the rate of 120 per hour.

Machining includes fly-cutting both flat sides of aluminum part; drill and ream two piston holes; drill three angular holes; drill, ream and chamfer the top holes. Flatness of the two sides is an important requirement.

Ex-Cell-O specials have the extra precision you have come to expect of XLO products. Why not check with your Ex-Cell-O representative today? Or write Ex-Cell-O, Detroit.

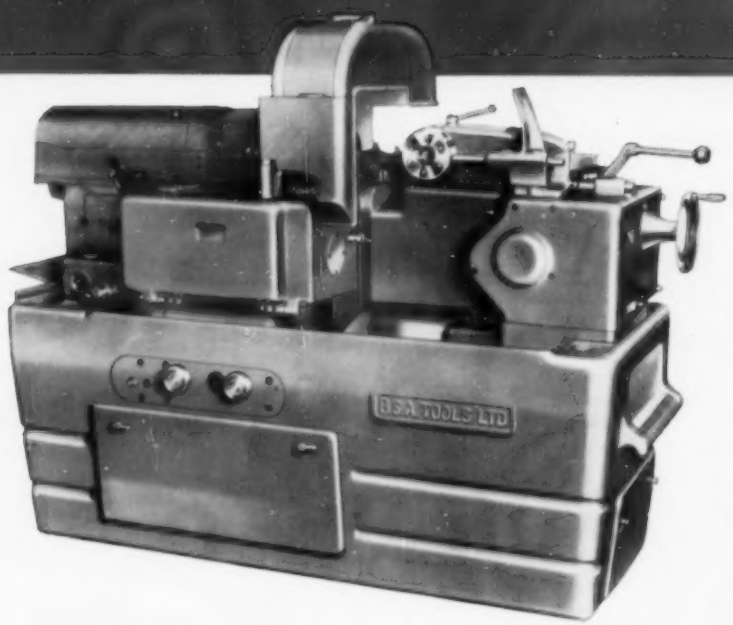
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-26

BSA first to provide UNIT REPLACEMENT of parts subjected to most wear

to keep important production flowing with new machine performance



With speeds, machining accuracy, ease of tooling and operation and maintenance equal or superior to any machine in its classification, BSA Single Spindle Automatic Screw Machines offer a very definite plus value through "*unit construction and replacement*" of work spindles, side slides, turrets and gear boxes.

Unit construction, plus extremely rigid, one-piece machine frame makes it possible to bring BSA machines back to factory standards of perfection quickly. You place an important unit back in the line with a minimum of lost production.

Shipment of replacement parts are speeded to you from National Acme, in Cleveland. Here, also, full engineering and design services as well as demonstration and service facilities, in the National Acme tradition, are available to you.

May we explain how "*unit construction and replacement*" can ease your production problems?

Additional Production Advantages of BSA

FIVE STANDARD CAPACITIES: ½" ¾", 1", 1½", and 2".

WIDE RANGE OF SPINDLE SPEEDS—200 to 6000 on ½" machine, 69 to 1260 on 2" model.

Cams, change gears and tooling easily accessible FOR QUICK JOB-TO-JOB CHANGEOVER.

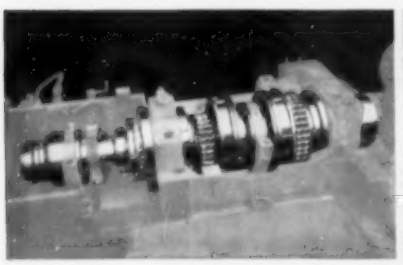
Unit construction provides quick access for EASY MAINTENANCE.

Special spindle mounting, DESIGNED TO REDUCE WEAR.

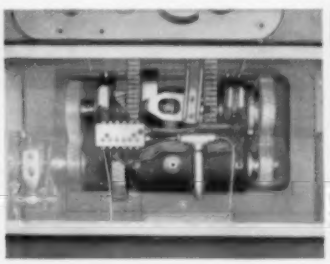
Positive chain drive from gear box to spindle PREVENTS SLIPPAGE.

All models use STANDARD AMERICAN TOOLING

UNIT CONSTRUCTION SPEEDS REMOVAL OR REPLACEMENT



Work Spindle



Gear Box

Side Slides and Turret

Distributed and Serviced in U.S.A. by...

National Acme

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